ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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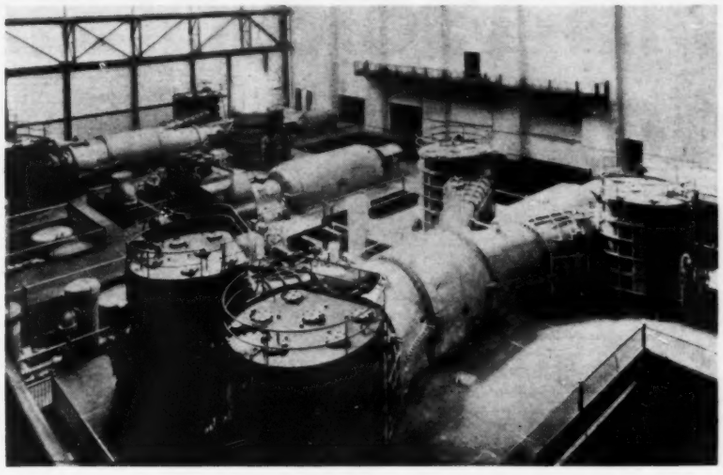

208,000-kw. triple-cross-compound unit State Line station

NOVEMBER 1, 1930

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McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

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CABLE ADDRESS: "MACHINIST, N. Y."

Published weekly. $5 per year. 25 cents per copy. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Member A.B.C.
Member A.B.P.

NUMBER OF COPIES PRINTED THIS ISSUE, 18,100

NEW YORK District Office, 285 Madison Avenue
WASHINGTON, National Press Building
CHICAGO, 520 N. Michigan Avenue
PHILADELPHIA, 1600 Arch Street
CLEVELAND, 501 Guardian Building
ST. LOUIS, 1556 Bell Telephone Building
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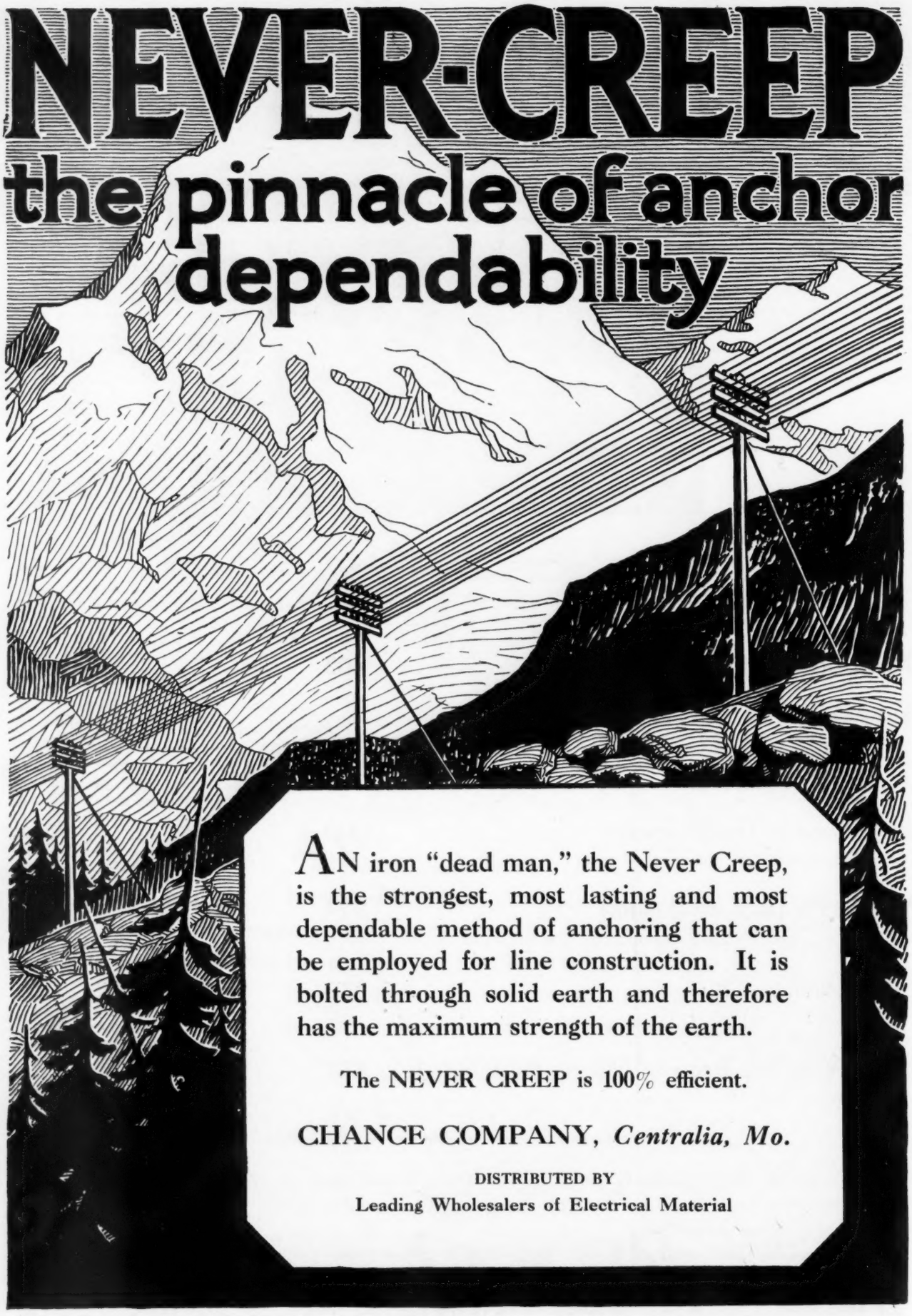

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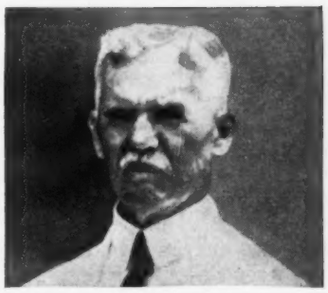
ELECTRICAL WORLD

for the Week Ending

November 1, 1930



"How much more difficult it is to fight against man than against matter! In my opinion material difficulties may always be mastered with some imagination and perseverance."

GEORGES CLAUDE,
Scientist, Inventor,
Power-from-the-Sea Proponent.

Election Day affects utility problems in many states

Claude to build 25,000-kw. plant on commercial basis

Copper price declines to 9½ cents; utilities are buying

—INSULL EMPLOYEES to aid the jobless. One day's pay a month for six months will be organized plan for relief measures. More than $100,000 a month involved.

—NEW YORK CITY rate hearings approach conclusion. Protestants warmly introduce contentious issues of long standing while company stands firm in its attitude toward equities.

—CLARION RIVER POWER Company seeks an injunction against Federal Power Commission as next step in preliminary-hydro-costs imbroglio.

—WATER POWER, regulation and ownership are among the problems forced on the electorate this year. Election Day may see some strange upheavals.

—REGINALD BELFIELD, another pioneer, recalls the early days of the industry. At the request of George Westinghouse he brought first transformer here.

—MONOPOLY not guaranteed to utilities, decides California Supreme Court, upholding State Railroad Commission action in recent case.

—N.E.M.A. HEAD urges "self-restraint" in business. Avoid abuses of the privileges of the established order, is warning of Clarence Collens.

—BOSTON EDISON welds 14-story home. Nearly a mile of welding, it required 6,120 kw.-hr. Best of all, strength of welds was definitely known.

—COPPER FALLS to 9½ cents per pound as producers face largest stocks of refined metal since 1921. Price lowest in 35 years. Sales heavy.

NEWS OF THE WEEK

Water Power, Public Ownership and Regulation in the Election

DEVELOPMENT of water power, public ownership and regulation of public utilities, together with attacks on the "power trust," have played a conspicuous part in a number of states in the election campaign now in its eleventh-hour stage. So many other issues, however, divide the voters and the industrial depression has provided so influential a background that it will not be easy, after the results are known next week, to say just how large a part in them the utility and power agitation had, except perhaps in Oregon, Washington and Nebraska, where there are referendums on specific questions. Senators Norris of Nebraska, Couzens of Michigan and Walsh of Montana, who have in different ways taken leading parts in congressional agitation over public ownership and regulation, are standing for re-election, as are, of course, many members of similar views in the Lower House. The situation in some of the states is summarized below.

NEW ENGLAND.—In Connecticut the dual rôle of J. Henry Roraback, who is at once president of the Connecticut Light & Power Company, member of the Republican National Committee and chairman of the Republican State Central Committee, has drawn the fire of former Dean W. L. Cross of Yale, Democratic candidate for Governor, and the efforts of Prof. Albert Levitt of Redding to cause the dismissal of the members of the Connecticut Public Utilities Commission for alleged neglect of duty have added to the commotion.

In Massachusetts the Democratic platform indorses the principle of the so-called Massachusetts method of basing utility valuation on prudent investment as against reproduction cost, but this indorsement has apparently failed, in the words of the Springfield *Union*, to cause "any perceptible agitation of the public mind."

In Maine, where William T. Gardiner was elected Governor in September notwithstanding his advocacy of the exportation of power, Frank H. Haskell (Democrat), opposing W. H. White (Republican) for the United States senatorship, charges that his antagonist is backed by the Insull utility interests.

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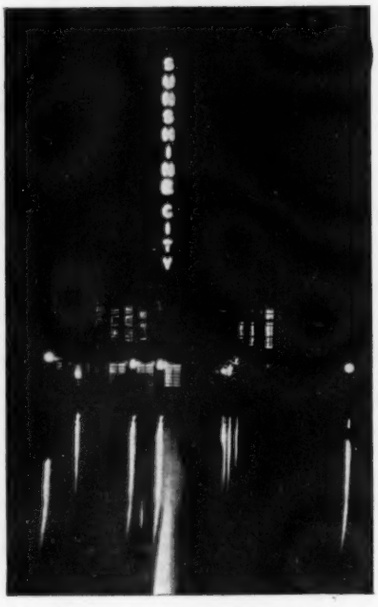
ON TAMPA BAY



Florida's largest neon sign, in letters six feet high, is visible for 20 miles across the tropic waters. It is on the stack of the Bayboro plant of the Florida Power Corporation of St. Petersburg.

NEW YORK.—Governor Roosevelt and his supporters have held out hopes of lower electric rates to come through his cherished plans of state development and distribution of St. Lawrence water power, pointing in support of their predictions to the tariffs of the Ontario Hydro-Electric Power Commission. This has, however, been far from constituting the main talking point of the Democrats, and the acquiescence of the Republicans in the appointment of the Governor's St. Lawrence commission has to a great extent removed the subject, temporarily at least, from political dispute. The Governor's belief that the Public Service Commission should function as a "militant protector of public rights" has also received emphatic expression.

PENNSYLVANIA.—Gifford Pinchot, Republican candidate for Governor, has made bitter attacks on the Public Service Commission of his state, pledging himself, if elected, to abolish the existing body and substitute an elected board. There have been, however, so many spectacular changes of party allegiance in the campaign on both sides, based on various grounds, that neither Mr. Pinchot's election—now regarded as in some doubt—nor his defeat could reasonably be ascribed to this one feature of his campaign. Mr. Pinchot also inveighs bitterly against the power companies, charging that four groups of capitalists in New York control nearly all the electricity produced in the country and dictate "most of the overcharging."

OHIO.—The Ohio Public Utilities Commission is severely criticised in a statement issued by George White, Democratic candidate for Governor, who charges that the commission has been dilatory in not disposing of rate cases involving millions of dollars and that employees and payrolls have been increased. "There are ways to cut red tape in regulating utilities," Mr. White says, "and as Governor I intend to see that the commission's docket is speedily cleared of old cases if I have to remove members of the commission to get the job done. The Pence law has been repealed, but its soul goes marching on."

WEST VIRGINIA.—A charge that the Republican state administration has been giving away valuable water-power grants has been used against the candidate of that party for Senator, James E. Jones, a wealthy coal operator. Ex-Senator M. M. Neely is his opponent.

NEBRASKA.—Senator Norris has kept the "power trust" peril as he sees it to the fore in his home state. His colleague, Senator Howell, was rebuked by the Nebraska Power Company for allegations of political activity by that utility, which flatly contradicted him and

DETROIT VEHICULAR TUNNEL GUARDS AGAINST ELECTRIC OUTAGE

The 5,135-ft. steel-tube vehicular tunnel between Detroit and Windsor, Ontario, under the Detroit River, ready to open November 1, employs electricity for ventilating fans, pumps, elevators, lighting and signal systems. At the Canadian end there are two 4,000-volt, 25-cycle lines from the Ontario Hydro-Electric System and at the American end two 4,800-volt, 60-cycle Detroit Edison lines. Energy from the two sources is reduced to a common utilization voltage and frequency of 2,400 volts, 60 cycles, but the two supplies are not tied together, their separate maintenance making complete failure very remote.

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demanded proof. Another cry was raised because of a personal contribution of $4,000 by Walter B. Head of Chicago, chairman of the company's directors, to help finance a pre-primary poll originated by opponents of Norris.

Attorney-General Sorensen and the Nebraska League of Municipalities are conducting a vigorous campaign for the adoption of an initiated law they sponsor which would not only permit existing municipal electric plants to finance extensions in whatever direction and as far as is deemed desirable by pledging future earnings of the entire plant, but would also allow new municipal plants to be similarly financed, merely by action of the City Council. The proposed law also requires a 60 per cent vote to sell a municipal plant. Opposing interests are submitting a similar proposal, which differs only in that such extensions can be made only when approved by a vote of the people. Mr. Sorensen says this would nullify the law since it would be necessary for a special election to build any one extension. Under the Nebraska constitution a majority of the votes cast on an initiated law, provided it represents 35 per cent of the total vote cast at the election, gives it full effect. Where conflicting measures are adopted, the one receiving the largest vote alone becomes the law.

SOUTHERN STATES.—In Alabama John H. Bankhead, the regular Democratic nominee for Senator, is accused of subserviency to the Alabama Power Company, and there is newspaper agitation for a state export tax on power. But neither in Alabama nor in Georgia, South Carolina and other Southern states in which agitation over utility rates prevails can such matters be said to be the uppermost ones in the minds of the electorate.

In the border state of Kentucky the agitation over Cumberland Falls cuts some figure, and in Tennessee Muscle Shoals is an issue in the district where Congressman Reece, with presidential indorsement, has declared against the Norris bill.

MOUNTAIN STATES.—In Colorado Edward P. Costigan, running for Senator against George H. Shaw, who is general counsel for the Public Service Company of Colorado, charges that that company, "by sheer weight of organized corporate wealth," controlled the Republican nomination. Similar charges were made by William V. Hodges, a Republican who contested the nomination of Shaw and who up to the time of his candidacy was himself a director of the Public Service Company. Mr. Shaw has refused to "repudiate a client in the hope of thus obtaining more votes" and, while denying that he will be a "power trust senator," proclaims that he is opposed to any form of public ownership or operation of utilities.

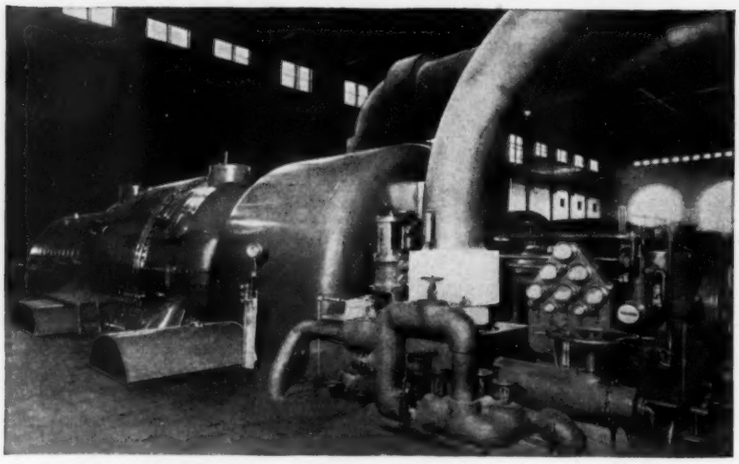
In Arizona, where the many-termed ex-Governor Hunt is again running on the Democratic ticket, irreconcilability to the Hoover Dam is bipartisan and will probably not be affected by the election.

On the Pacific Coast

OREGON.—In Oregon the so-called "people's water and power utility districts constitutional amendment" will be voted on. This measure would amend the constitution to provide for the creation of utility districts in territory, contiguous or otherwise, within one or more counties and which may include one or more incorporated municipalities. Such districts are to be managed by a board of directors of five residents with extraordinary powers to levy taxes and to issue and sell bonds. Proponents insist that the only reason for the submission of this measure, which has been brought before the people by initiative, is to give rural districts the same privileges now enjoyed by municipalities with respect to entering the power business. Opponents claim that such districts may now be provided for by the Legislature without recourse to specific constitutional authority. They point to the lack of limitations on the tax levying and bonding powers in the measure as a grave danger which might lead subdivisions of the state into unwarranted spending.

The power issue also bulks large in the campaign for the governorship. It was first made an issue by the regular Republican nominee, George W. Joseph. His death in June threw the nomination into the hands of the Republican State Central Committee, which named Phil Metscham, whose personal beliefs were known to be at variance with those of the deceased nominee. An independent

WAUKEGAN'S NEW 65,000-KW. UNIT



The new Allis-Chalmers tandem-compound unit at the Waukegan station of the Public Service Company of Northern Illinois operates at 600 lb. and 725 deg. F. Pulverized fuel is burned, one of the three boilers containing a reheater to handle 550,000 lb. of steam. Three 20,000-kva. G.E. transformers, each with unit air circulation, raise the 12,000-volt output to 132 kv.

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group then nominated Julius L. Meier as an independent candidate to run on the Joseph platform. His policy includes active support of the proposed amendment, abolishment of the Public Service Commission and the return to home rule, state or municipal development of water-power resources and the development of the power of the Columbia River by the federal government. Mr. Metscham opposes all this except that he would support plans for federal development of the Columbia and Willamette Rivers.

The Democratic nominee, Edward F. Bailey, would "preserve our hydro-electric power resources for the public benefit forever by withdrawal from private appropriation of all waters which will afford economical development by public agencies." His program demands immediate development of the Columbia River by the federal government, encourages ownership and operation of light and power projects by municipalities, and favors state development of such water-power projects as may not be practical for municipal development. His platform also contains a plank looking toward lower public utility rates effectuated by a Public Service Commission dedicated to this purpose.

WASHINGTON. — In Washington the initiative measure to be voted upon is known as the "district power bill" and sponsored by the Washington State Grange. The stated purpose of the proposed act is to conserve the water and power resources of the state for the benefit of the people and to supply public utility service, including water and electricity, for all uses. To accomplish this purpose it authorizes the creation of municipal corporations, called public utility districts, comprising an entire county or any portion thereof, and permits the consolidation of two or more contiguous districts into one. A district may be formed by vote within the proposed district at any general election, and the proposal to form such a district may be made by the county commissioners either on their own motion or pursuant to a petition of 10 per cent of the voters of the proposed district.

The act gives to public utility districts the right to construct and operate waterworks, irrigation systems and power plants, either steam or hydro-electric; to purchase or condemn lands within or without the limits of the district; to sell water or electrical energy within or without its limits and make its own regulations with respect thereto, free from any control by the Department of Public Works; to issue general obligation or utility bonds; to levy an annual tax not exceeding 2 mills in any year, exclusive of interest and redemption of general obligation bonds, and to "do all things necessary to carry out the provisions of this act." A commission of three voting freeholders of the district, elected for three-year terms, would appoint a manager.

The Grange contends that the bill simply extends to rural districts powers already possessed by incorporated cities and will enable the smaller cities and towns also to take advantage of them. Opponents of the bill maintain that under the wide powers conferred by the measure a power district in one county could take over power plants and distribution lines and irrigation systems in another county against the will of that county and that the measure would remove additional millions of dollars of property from the taxroll. Proponents of the bill argue that its mere passage will force down the rates of the private companies and that the saving thus made would far exceed any loss in taxes.

CALIFORNIA.—In California there is no state-wide measure affecting either water-power development by municipalities or utility regulation, but in San Francisco a charter amendment creating a city public utilities commission will be submitted to the voters. This amendment was explained in the ELECTRICAL WORLD for October 4 (page 631). No active campaigning is being done on this measure and not much interest seems to be displayed. In Los Angeles citizens will vote on the power bond issue for $13,300,000 proposed by the Board of Water and Power for expansion of the municipal system.

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Discredits Stories of Political Expenditures

REPLYING INFORMALLY to allegations contained in a complaint filed by the Oregon State Grange that the Northwestern Electric Company and the Pacific Northwest Public Service Company of Portland are expending money to purchase publicity in opposition to the Grange initiative measure, the "people's water and power utility" amendment, and charging such expenditures up to the consumers, Public Service Commissioner H. H. Corey asserts that a practice of this nature has never been, in the history of the regulatory body, either attempted by the utilities or approved by the commission. Neither is there any existing evidence to show that the commission has ever had occasion to disallow operating expenses of this character. In order to convince the complainants, however, the commission has decided to order a hearing and invite all parties interested to review the past and present records of the department dealing with such matters.

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Another Byllesby Plant Goes Into Commission

DEDICATION OF THE NEW Minnesota Valley steam generating station of the Northern States Power Company at Granite Falls, Minn., took place recently when 174 officials of the company and visitors made a tour of inspection and enjoyed a dinner in the plant, which contains two 10,000-kw. generators. One had been in operation for several weeks, and the second was in readiness.

Union Electric Rate Inquiry Under Way

INQUIRY INTO THE RATES of the Union Electric Light & Power Company by the Missouri Public Service Commission at Jefferson City has been recessed to November, when H. W. Ross, chief accountant for the commission, will resume the stand to explain the various summaries of the electric company's accounts made in the commission's audit. The auditors fixed the valuation of the company at $57,362,000, not including either "going value" or intangibles.

The company will contend for a much higher valuation and endeavor to have included a number of items omitted by the state auditors. On the investment-cost basis the company contends that its properties are worth $83,529,225. It has consistently declined to claim the right to earn returns on the reproduction-new theory. It will insist that its investment in the Osage River hydro-electric project must be considered, since any rate-base valuation the commission may adopt cannot be effective until that project is in service.

The purpose of the hearing is to determine whether the Union company cannot make a further reduction in rates in St. Louis. The city of St. Louis will not take part in the rate proceedings until the state commission, which instituted the investigation, has completed its testimony.

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New York Rate Hearings Warm Up Near Close

AS THE RATE HEARINGS before the New York Public Service Commission affecting the New York Edison and associated companies draw to a close the long-smoldering elements of contention in electric utility matters in New York City have become active once more. This week, following further cross-examination of President Sloan, it seemed probable that the hearings might be concluded with comparatively little further presentation and discussion of evidence, though irreconcilable differences of opinion as to the equities involved were evident.

At Wednesday's session clashing viewpoints of representatives of the city, submetering companies, real estate organizations, industrial engineers and the utility companies were exhibited. "These hearings," said Judge Shearn, counsel for the Real Estate Board, in claiming that nothing so far had been proved but that bills of 51 per cent of the customers would be raised, "would be over in a day and every one would be in favor of the reduction, because no one could afford not to be, if a general reduction in which every one might share were proposed." Corporation Counsel Hilly of the City of New York charged that "the primary purpose of the offer is to increase the revenues of the company and not to reduce them." E. F. Jeffe, industrial engineer, charged the companies with making a profit out of the coal clause when coal prices rose above incremental limits. All of these contentions and many others were denied by representatives of the companies. The hearings were continued on Thursday.

Mr. Sloan made the following summary of his contentions for the press:

We have given the commission our best judgment based on our experience, and we have asked for a fair trial of the forms of rates we have proposed. It is our judgment that our new rates will be acceptable to our customers and that the improved forms will enable not only the immediate results but also still further reductions.

We are prepared to go ahead and cut at least $6,000,000 a year from the cost of electric service to our present customers. Those who are engaged in the submetering and resale of electricity within our franchise territory to thousands of tenants who would otherwise be our customers are now objecting to our proposals for reductions in rates to our customers. Their reason must be that they are unwilling to make for their submetered customers the same reductions and improvements in rates which we are willing and ready to make for our customers. They say that they charge the rates which we charge, and that our new rates would reduce their profits and so drive many submetering concerns and landlords out of the submetering business.

Our new rates were not formulated for any purpose of direct or indirect effects upon submetering. I have not ventured a forecast as to what those effects might be. But the question arises whether the regulated electric companies shall be prevented from reducing their rates $6,000,000 a year and improving their form because the submetering agencies are unwilling to reduce their rates and profits correspondingly.

We believe we have shown our good faith in the matter of rate reductions. We now offer what in our judgment is the only way to the present reduction and to further reductions. We ask a fair trial of the plan recommended by our judgment and experience.

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Minneapolis Plant Is Undergoing Enlargement.

A SUBSTANTIAL ADDITION to the power resources of Minneapolis and a help in relieving non-employment have been undertaken by the Northern States Power Company at its Riverside steam plant, where a 35,000-kw. turbo-generator is to be added, with boiler capacity to take care not only of the new machine but of a probable future addition of 50,000 kw. more. When the generating unit now ordered is installed the Riverside plant will have a capacity of 110,000 kw.

Four hundred and fifty men are laying foundations, which will be considerably deeper than the bed of the Mississippi, upon which the plant abuts, to permit the remodeling of the north end of the station to accommodate the new equipment.

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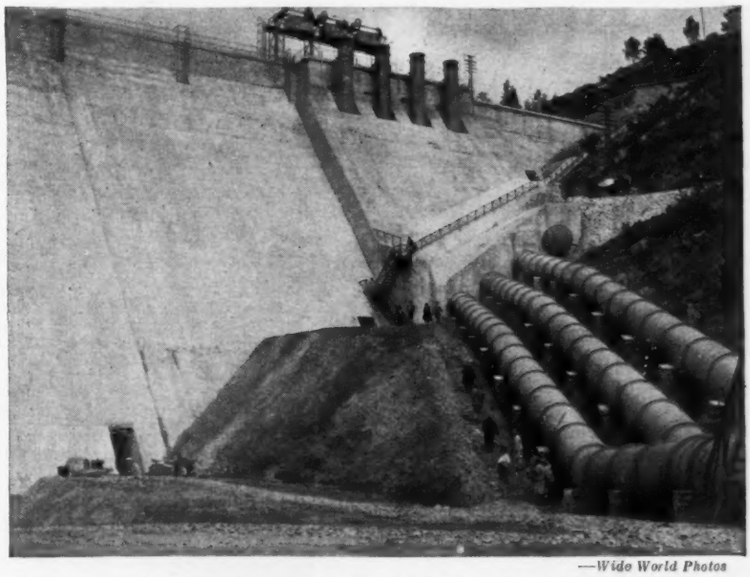
HYDRO-ELECTRIC PLANT TO SERVE BRITTANY



—Wide World Photos

L'Union Hydro-Electrique Americaine has built upon a section of the canalized river running from Nantes to Brest in France a dam 705 ft. long, 148 ft. high and 108 ft. thick at the base. The turbines will supply a large part of Brittany with energy.

Engineering Foundation to Help Technical Study

STEPS TO PROMOTE engineering education were taken at a meeting of the Engineering Foundation held at the University Club, New York, recently. Representatives of engineering societies, educational institutions and industries took part in a forum over which the chairman of the Foundation, H. Hobart Porter, presided.

An announcement by Mr. Porter told of the recent appointment of an education research committee under the chairmanship of Dr. Harvey N. Davis, president of Stevens Institute of Technology, representing the American Society of Mechanical Engineers, other members being Prof. William B. Plank, representing the A.S.M.M.E.; Prof. Harold B. Smith, the A.I.E.E.; R. I. Rees, the S.P.E.E.; Prof. Alfred H. White, the American Institute of Chemical Engineers, and Robert E. Doherty, the Engineering Foundation. A representative of the A.S.C.E. has not yet been designated.

Dr. Davis said that the committee must make some sort of a survey from without of engineering education and of the relations thereto of engineering societies and the industries. "Of what good is the survey of the American Society of Mechanical Engineers now being made and how can it be helped?" he asked. "How can the co-operation of engineering societies with the Society for Promotion of Engineering Education be furthered?"

Messrs. Porter and Rees spoke at length, and Gano Dunn, Prof. Charles F. Scott, Dr. Charles R. Mann, Dean F. L. Bishop, George A. Orrok and Dean R. L. Sackett were among others who took part in the conference.

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Puyallup and Centralia Suits Against Company

THE CITY OF PUYALLUP, WASH., has won its condemnation suit to acquire the Puyallup distribution system of the Puget Sound Power & Light Company, a jury in the United States District Court in Tacoma having fixed $216,825 as the damages to which the company is entitled for the physical assets and severance of the Puyallup unit of the company. The Puget Sound Power & Light is likely to appeal, its counsel having taken several exceptions to the court's instructions, particularly those relating to severance. The case occupied the court for twenty days.

The case of the city of Centralia against the Puget Sound Power & Light Company, involving water rights and regarded as of fundamental interest to all power interests and other users of water in the state, which was to have been heard in October, has been set over until December 2.

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Monopoly Not Guaranteed to California Utilities

A DECISION OF IMPORTANCE to utilities in general was rendered on October 20 by the California Supreme Court, which upheld the California Railroad Commission in its ruling that "it is incumbent upon every utility in this state to be abreast of public needs, regardless of whether there is competition facing it or not," and that "a utility must assume the obligation of providing reasonably good service to its patrons if it expects to hold the field." The decision upheld an order of the commission granting a certificate of public convenience and necessity to the Automobile Ferry Company of Coronado despite the existence of another company operating between the same points as would the new company.

The Supreme Court held that the commission's finding was one of fact and not subject to review by the court. It said in part:

The Railroad Commission has discussed at length its views with reference to the new policy of the law in this state advanced by the constitution and the statute on the question of regulated monopoly and competition. There is nothing in their declarations of policy inconsistent with the order now under attack. The policy as declared by the statute and applied by the commission has never gone to the length of guaranteeing monopoly in all cases, but has at all times deemed the public interest as of paramount importance. It has announced that when an existing utility has fallen short of its full duty to the public it will not necessarily be protected against competition, and that its activities before and at the time competition knocks at the door may be taken into consideration notwithstanding protestations of better behavior in the future.

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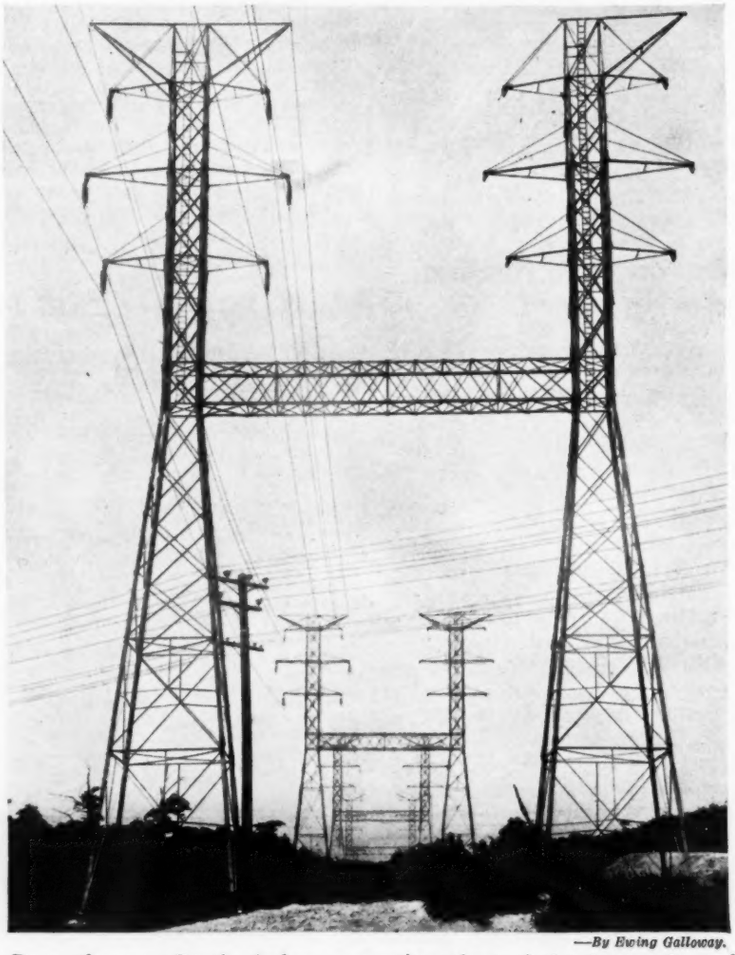
JERSEY UTILITY'S BRIDGE-TYPE TOWERS



—By Ewing Galloway.

From the new South Amboy generating plant of the Jersey Central Power & Light Company 66/132-kv. transmission lines are carried on these towers, exemplifying a new type of design and construction.

Fall Illumination Conferences at G. E. Institutes

NOVEMBER ILLUMINATION CONFERENCES will be held at the General Electric Lighting Institutes as follows: November 3-8, home-lighting course, Nela Park, Cleveland; November 10-12, lighting conference, Harrison, N. J.; November 17-22, general course in illumination, Nela Park. At each conference talks on ten or more topics by men of prominence in their special fields will be given, and a wide range of lighting use will be covered.

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Asks Injunction Against Power Commission

THE THREE CABINET SECRETARIES composing the Federal Power Commission have been ordered to show cause on November 7, before the Supreme Court of the District of Columbia, why an injunction should not be granted the Clarion River Power Company of Johnstown, Pa., in connection with the proposed elimination of items of cost aggregating $6,387,731 incurred in the construction of the power company's Piney Branch project. The power company contends that the commission is acting in excess of its authority in adopting rules of practice which provide that in the event no protest is filed to a preliminary accounting report the commission may make such final order as may be appropriate, and that unless the licensee submits evidence in support of its protest, the protest shall be deemed abandoned. (ELECTRICAL WORLD, August 30, page 375.)

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Railroad and Utility Make Reciprocal Deal

AGREEMENTS ARE REPORTED between the Pennsylvania Power & Light Company and the Philadelphia & Reading Coal & Iron Company under which the coal and iron company sold to the power and light company its electric generating plants at Locust Gap and Goodspring, Pa., and transmission and distribution lines, rights-of-way and other facilities in Northumberland, Columbia and Schuylkill Counties, Pa. The property includes a power site at Herndon, Pa., adjacent to the Susquehanna River, and an extensive power development on that river is said to be contemplated.

In payment for the properties the coal and iron company will receive shares of the capital stock of the National Power & Light Company. The Pennsylvania Power & Light will purchase Reading anthracite from the Philadelphia & Reading Coal & Iron, and the latter will purchase its electricity from the former.

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Coming Meetings

National Electrical Wholesalers' Association—Pittsburgh, Nov. 10-14. E. Donald Tolles, 165 Broadway, New York.

National Association of Railroad and Utilities Commissioners—Charleston, S. C., Nov. 12-15. J. B. Walker, 270 Madison Ave., New York.

Public Utilities Association of Virginia—Virginia Beach, Nov. 13 and 14. C. O. Robertson, Roanoke.

American Institute of Electrical Engineers — Southern District, Louisville, Nov. 19-22; winter convention, New York, Jan. 26-30. F. L. Hutchinson, 33 W. 39th St., New York.

American Society of Mechanical Engineers—New York, Dec. 1-5. C. W. Rice, 29 W. 39th St., New York.

Pacific Coast Electrical Association—Engineering Section, Los Angeles, Dec. 10-12. S. H. Taylor, 447 Sutter St., San Francisco.

North Central Division, N.E.L.A.—Commercial meeting, Nicollet Hotel, Minneapolis, Jan. 26 and 27; engineering meeting, same place, Feb. 23 and 24. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Midwest Power Engineering Conference — Chicago, Feb. 10-13. G. E. Pfisterer, 308 W. Washington St., Chicago.

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Several Utility Properties to Change Hands

ALL PUBLIC UTILITY PROPERTIES headed by Walter Whetstone of Philadelphia are, it is announced, being taken over about November 1 by the Central Public Service Corporation of Chicago. The plants to change hands include the Southern Cities Utilities Company, controlling electrical operating subsidiaries in San Domingo, Hayti and Majorca and gas and other utility companies in the Southern States. The Central Public Service Corporation is understood to be controlled jointly by A. E. Pierce & Company of Chicago, the Public Utility Holding Corporation of America, sponsored by Harris, Forbes & Company, and the American Founders' Corporation.

Negotiations are under way for purchase by New York interests of a majority of the controlling stock in the Scioto Valley Railway & Power Company, Columbus, Ohio. The company supplies light and power to numerous rural communities in its district.

Effective as of October 1, the Public Service Commission of Alabama approved sale of all properties of the Georgia Power Company in Alabama to the Alabama Power Company. Most of the property is at Phenix and Girard, opposite Columbus, Ga. The sale of the property will permit of certain rate revisions.

Claude Plans to Develop Sea Power Commercially

AS THE NEXT STEP in his series of experiments to harness the sea in tropical regions by the development of electrical energy from low-pressure turbines operated by sea water of different temperatures, M. Georges Claude, eminent French scientist, inventor and accomplisher of supposedly impossible engineering feats, will endeavor to make a commercially practicable installation. This was announced by M. Claude at a Power Section meeting of the American Society of Mechanical Engineers in New York this week. More than 1,200 heard the inventor explain details and principles of his process as well as the continued disappointments which have terminated in a sufficiently satisfactory production of 22 kw. from a small turbine.

"Without belittling the difficulties that remain to be solved," said M. Claude, "I affirm my faith in plants running ceaselessly without being hampered by the scarcity of waterfalls or vagaries in the cost of coal. I hold that all this is not the task of a remote future, but of tomorrow."

The proposed commercial plant will probably be started near Santiago, Cuba, within a few months. It will be of 25,000-kw. capacity and cost about $3,000,000. This size will not be sufficiently great to reach the predicted cost for large installations of $60 per kilowatt.

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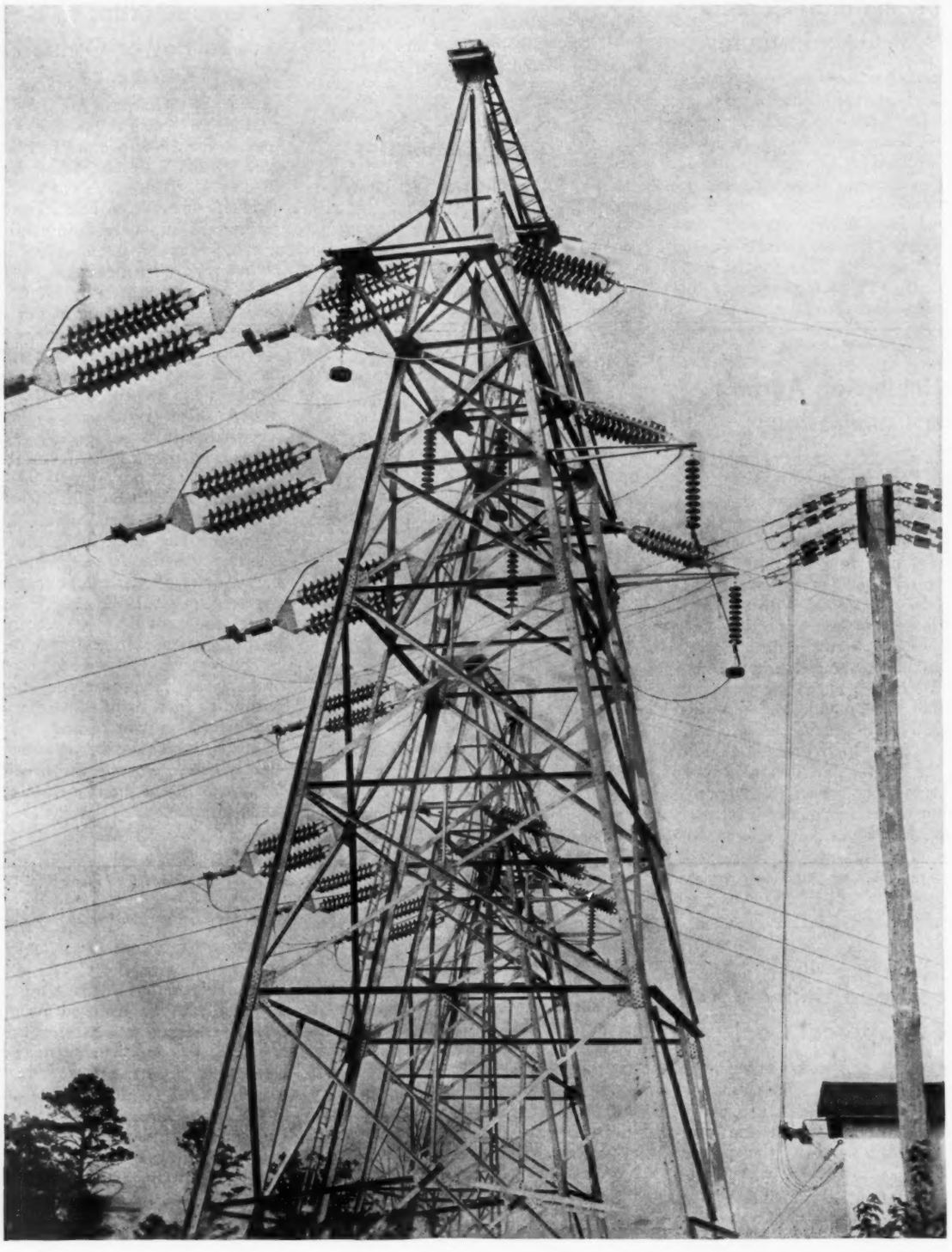
Engineers Will Tell of Research on Insulation

THE FUNDAMENTAL NATURE of insulation problems in the electrical industry is so obvious that engineering attention is certain to be aroused by the third annual meeting and conference of the committee on electrical insulation, division of engineering and industrial research, National Research Council, to be held on November 7 and 8 at the Bureau of Standards, Washington. Dr. J. B. Whitehead of Johns Hopkins is the chairman, and among scheduled papers are the following:

"Short-Time Characteristics of Insulating Oils," J. B. Whitehead.
"Nature of the Conductivity of Insulating Oils," K. F. Herzfeld.
"Electrical Characteristics of Insulating Oils," H. H. Race.
"Predetermination of the Deterioration of Impregnated Paper Insulation," D. W. Roper.
"Behavior of Hydro-Carbons and of Paper Under Electric Discharge," C. F. Hirshfeld.
"Cable Research at the University of Illinois," E. B. Paine.
"Insulation Research at the Massachusetts Institute of Technology," V. Bush.
"Ionized Gas Films in Solid Dielectrics," C. L. Dawes.
"Life of Impregnated Paper Insulation," J. B. Whitehead.
"Analysis of Loss in Impregnated Paper," W. B. Kouwenhoven.



Dead-End for 5,084-Ft. Span

This construction is used to support the ends of a 5,084-ft. span of two 150-kv. circuits across the Little Tennessee River near Alcoa, Tenn.: Conductor weight, 2 lb. per foot; tension of 20,000 lb.; steel core, $\frac{7}{8}$ in. diameter, carries whole stress; compression spring in cylindrical inclosure; turnbuckles form tower attachment; six high-strength insulator strings per conductor; weights on suspension units supporting jumpers; extra conductor normally grounded but available for emergencies. (See page 822.)

EDITORIALS

L.W.W.MORROW
Editor

Impressions of the N.E.M.A. meeting

MORE unity of purpose and zeal for progress in raising industry standards than have always been exhibited characterized the meeting of the National Electrical Manufacturers' Association last week. This organization has passed through the throes of rebuilding and has come to be a compact and efficient unit. It deals effectively with internal affairs, and its representatives meet with other industry groups as men fully instructed and authorized to speak for the manufacturers. It has able leaders who have taken a constructive attitude in all activities that advance the upbuilding of the industry.

The making of standards, the adoption of uniform cost accounting, the compilation of statistics and the development of better trade practices are tangible accomplishments of the N.E.M.A. In addition, it has helped greatly to establish a business psychology and confidence that has borne fruit in these times of stress. In this business depression the manufacturers are meeting the situation calmly and with very little disruption of industry practices. Basing their efforts upon a sober analysis of conditions and upon confidence in one another, they are courageously striving to bring about improved business and to handle existing business without destructive competition. There is no doubt that the leadership and the personal contacts built in the N.E.M.A. are largely responsible for this attitude.

Much remains to be done by the manufacturers, however, both among themselves and in conjunction with other groups. Methods for market development, sales analysis, sales organization, economical distribution—many topics come to mind involving the choice of principles to apply to the industry program of electrical market development. Each group in industry has a part in the market situation and, within its own ranks as well as in co-operation with other groups, can help arrive at the principles and practices which will best aid economical sales—the goal of all groups. It is encouraging to note that the N.E.M.A. is working at internal manufacturing problems and also trying to play a constructive part in comprehensive industry problems.

Where stand utility commons?

SAVINGS money in appreciable amounts is invested in the common stocks of the operating properties and holding companies of the power industry. When current prices are checked against the original purchase prices not a few investors are disquieted to find the market values of these stocks below cost, and it is only human to question the future prospects. No one can predict the future, but sane analysis indicates that there is no reason to be alarmed about the fate of high-grade stocks and that the loss of courage is unwarranted.

The market for electrical energy is as assured as anything can be in modern civilization. Over a period of years the growth of electrical service will command new capital on a vast scale. There may be temporary setbacks in the revenues derived from specific classes of customers or businesses, but there can be no turning backward in the use of electricity unless the people of the world come to prefer darkness to light in every sense of the words. Political attacks cannot stop this progress even though they may slow it down for a time. Reasonable profits may be expected with confidence to continue to reward the investor. If one's objective is primarily investment for long-

time income, the industry, so far as anything on the horizon reveals, can be counted upon to reward such thrift with a fair return. If one's objective is appreciation and subsequent profit taking, he must weigh present earnings and rate of growth in the prices he pays, bearing in mind that the probabilities favor long-run increments of value in the power industry while the possibilities include further recessions, temporary though they may be. From the over-all income-bearing viewpoint of the conservative investor, utility commons of the higher grade deserve cordial consideration both in times of depression and times of prosperity.

Shall switchboards be billboards or pages?

TO A CERTAIN degree the size of switchboard panels has been fixed by the minimum dimensions of the requisite instruments. Scale length and legibility were deterrents to smaller size as well as the obstinacy of the working parts and accessories to space compression. Much has been done to improve legibility and economize in size, with consequent reduction in panel dimensions or improvement in space utilization. But the switchboard is still a billboard viewed at relatively long range, with much of its area outside the operator's immediate reach and vision.

In some ways a board which would give the operator the same nearness to his objects that the organist has to his console or the telephone operator to her board would offer distinct advantages. With everything at arm's reach and the eye's grasp, the board would assume the status of the printed page in its optical superiority as to focusing and embrace. Miniature instruments are on the point of making all this possible. Some alternating-current instruments based on the rectification principle are already down to dollar-watch size. They do admittedly carry present doubt as to the permanence of the accuracy of rectification ratio, but research will surely eliminate this uncertainty. With the instrument providing a possibility of reducing panel sizes and aggregate board area, the pressure will shift to the control devices to reduce their dimensions in order to realize what advantages there are in a "page-size" panel. The new miniature switchboards are in order.

New thought stirring in the load-building problem

SEVERAL experiments are under way right now in different parts of the country that give hope for the eventual solution of those problems of local trade relations that have beset the electrical industry so long. Apparently out of the talking phase of argument and contention in which dealer, contractor and power company have questioned and decried each other's policies and practices the situation is now developing into an earnest effort to find a better way of doing things, to establish a sounder basis for merchandising appliances and building load. Some of these experiments are old and pretty well proven. Some are new.

Ten years ago at least in Fresno a so-called "through-the-dealer plan" was instituted, one of the first large-scale attempts to build up volume sales through independent retailers. It was looked upon by other power companies more or less indulgently as a freak endeavor of a semi-philanthropic sort. But within the past few seasons in other cities other plans have been established. In Boston they are paying commissions to contractors on sales of appliances by the utility to wiring customers reported by the contractor. In Georgia very long-term easy-payment contracts on combinations of major appliances are being financed by the power company on a basis that assists the dealer. In the Hudson Valley the utility has been acting as jobber to provide appliance stocks to dealers and improve their position on purchase and sale. In Greenfield, Mass., the central-station company is paying for range wiring at a price that makes a market for the dealer. And with variations these and other plans are under trial in other cities, the Southern California Edison Company being the last to announce new merchandising policies fashioned for the encouragement of dealer sales.

Which policy is right, which plan is best no man can say as yet. The point of interest is that new thought is now stirring in the industry and an earnest searching for solutions has succeeded the old prejudice and animosity that on both sides impeded the progress of a better co-operation between the utility people and "the trade." Much should come out of it, and there is no more

pressing job before the N.E.L.A. Commercial Section this year than the analysis of these experiments now under way, that the entire industry may be able to compare them and judge their value.

Opposing political efforts on the Coast

FROM one end of the Pacific Coast to the other electrical utilities are involved in politics in one form or another. On November 4 Washington will vote on the district power bill and Oregon will vote on the Grange bill. The two measures are strikingly similar. They provide for public utility districts with bonding power to provide water supply and develop electrical energy. Similar bills have been defeated in both states before, but there is a general feeling of unrest and electric utilities of the Northwest are none too sanguine over the outcome. San Francisco is temporarily out of the limelight, having voted down a bond issue of $67,000,000 for municipal distribution by nearly three to one on August 26.

In Los Angeles the city Bureau of Power and Light seeks a bond issue of $13,200,000, which, with $12,000,000 from surplus revenue, would be used to finance a three-year construction program. An interesting aspect of the Los Angeles situation is that, after years of reasonable freedom from politics, the water and power departments are becoming more and more involved. About two years ago the two departments were reorganized and placed under one head. After a year a new régime restored things to their former status. Now the Mayor proposes to consolidate the departments again and "eliminate politics" in the water and power departments.

Of importance, too, is the political and legal squabble going on over the state constitutional amendment under which the Los Angeles Gas & Electric Corporation operates. In 1885 a constitutional amendment gave utilities the right to use streets for supplying gas and electricity for "lighting." The city now contends that the company has no right to supply electrical energy for power service and seeks to restrain it from so doing or to force acceptance of a fifteen-year franchise providing for a 2 per cent gross earnings tax and giving the city the right to take over the property at the expiration of the franchise. A suit now rests in the Superior Court for decision. No matter what the decision, it is said the case will be appealed. Elsewhere on the Pacific Coast several small cities are investigating municipal ownership, particularly in California, where there is a large supply of cheap natural gas available.

Notwithstanding all these political rumblings, utilities are going ahead with unshaken confidence, fighting for the rights of private business. Public relations are an every-day year-in-and-year-out task for each utility, and sporadic efforts should not be relied upon to defeat inimical legislation.

Electrical construction shows faith in future

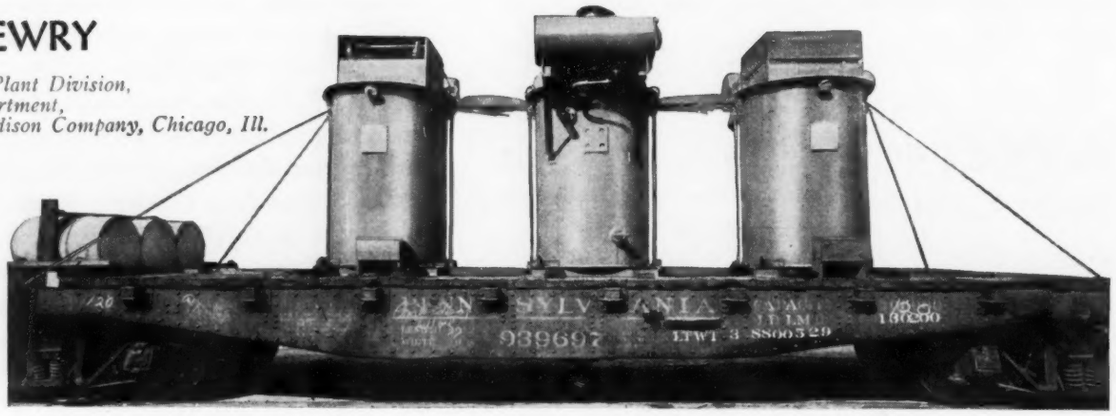
IN THE brief interval from mid-August to the end of October important new generating stations and extensions aggregating approximately a million kilowatts were placed in utility service or reached the verge of being so placed. Construction of these plants and of plants of less size which might swell the figures appreciably represents only a part of some $900,000,000 which the utility industry is spending this year for generating stations, transmission lines, substations and distribution. This work has given employment not only to local labor but to makers of equipment and to raw material producers at a time when employment was sorely needed.

Meanwhile the demand for energy has dropped below last year's level. But utilities must always be ahead of demand, and to be so they must start building before the demand actually exists. If for the moment these new facilities provide an excess of reserve, the demand will soon catch up. Even a major fluctuation in business conditions like the extraordinary decade of 1914-1924 put a comparatively small hump in the long-time curve of electrical growth. The power industry takes the country's continued progress for granted. By acting according to that faith it will help to give employment to many in a time of stress and to stabilize business conditions. Continuance of the contruction program will be a tangible contribution to good public relations.

Protecting Power Equipment

By R. H. EWRY

Inspector Inside Plant Division,
Engineering Department,
Commonwealth Edison Company, Chicago, Ill.



For heavy pieces

Transformers, regulators, oil circuit breakers, reactors, etc., should be anchored to the car underframe by the application of bolts inserted through the base of the apparatus. A guy rod should be bolted to the top of the apparatus at each end of the load, extend down at an angle of not less than 45 deg. and be attached to the underframe of the car by a suitably designed anchor plate. If more than one piece of equipment is loaded on the same car, they should be so aligned that the tops can be tied together by the use of horizontal anchor links.

This should not happen

This shipment of circuit breakers was not braced in the car to prevent toppling over and skidding when impact was sustained. The porcelain in the assembly of the switch was shattered and several of the iron tanks were cracked. Toe cleats, bolted to the car floor at the base of the crates with braces at a 45-deg. angle, steadying the top of the load, probably would have prevented this.

PACKING and loading instructions are closely related, not only to the design, fabrication and operating characteristics of individual pieces of electrical equipment, but also to the same matters in the installations into which these pieces are integrated. Therefore specifications covering packing and loading must be made a part of a purchase order for equipment so that it can be transported efficiently, safely and economically.

Three reasons emphasizing this necessity are:

(a) Equipment must be loaded and packed and thus must have a rugged design and construction which will withstand more than average shocks due to impacts while in transit.

(b) Limited clearances of bridges and tunnels require special consideration because, obviously, they affect overall dimensions and structural design.

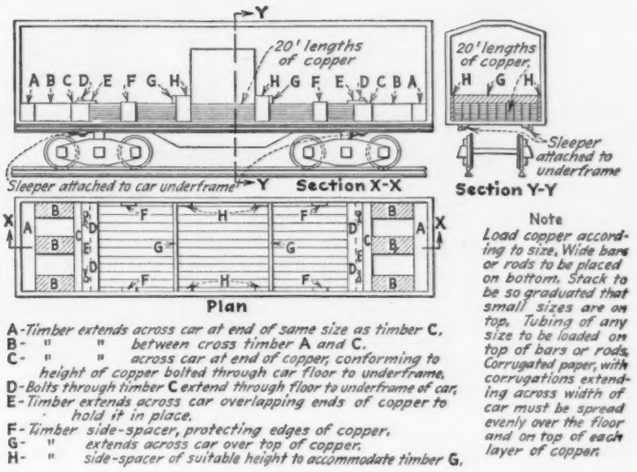
(c) Special appurtenances and devices must be included in the design of the equipment so that it may be packed, handled and moved in a safe and economical manner.

It has been found economical by the Commonwealth Edison Company to carry on a study of packing and loading methods in order to reduce damage in transit to electrical equipment, to avoid extremely costly delays to installation schedules and to eliminate loss of the use of equipment. Our investigation indicates that not until the last ten years had much thought been given the subject of packing and loading. Because of this apparent lack of interest in the subject by the shipper it was necessary that all packing and loading methods should be studied in order that crates and shipping containers adequate to serve the purpose for which they are intended might be designed. Many vendors have failed to appreciate how vitally their business is affected because they do not interest themselves in the condition in which their shipments arrive at their destinations.

Packing and shipping specifications are prepared by the equipment-procurement section of the engineering department of the Commonwealth Edison Company, covering all of the electrical apparatus and material used in its stations and substations. This is done to insure

During Transportation

Heavy equipment should be anchored to car underframe end braced by guy rods. Crates should be scientifically nailed and braced. Equipment in crates with skid foundations should be bolted to skids. Transformers on depressed-bottom cars should be bolted to car underframe, guyed and blocked. Double-walled, corrugated fiber board proves satisfactory for packing smaller equipment.


Y
20' lengths of copper
A B C D E F G H
H G F E D C B A
20' lengths of copper
H G H
Sleeper attached to underframe
Sleeper attached to car underframe
Y
Section X-X
Section Y-Y
X
A
B
C
D
E
F
G
H
Plan
Note
Load copper according to size. Wide bars or rods to be placed on bottom. Stack to be so graduated that small sizes are on top. Tubing of any size to be loaded on top of bars or rods. Corrugated paper, with corrugations extending across width of car must be spread evenly over the floor and on top of each layer of copper.
A-Timber extends across car at end of same size as timber C.
B- " " between cross timber A and C.
C- " " across car at end of copper, conforming to height of copper bolted through car floor to underframe.
D-Bolts through timber C extend through floor to underframe of car.
E-Timber extends across car overlapping ends of copper to hold it in place.
F-Timber side-spacer, protecting edges of copper.
G- " extends across car over top of copper.
H- " side-spacer of suitable height to accommodate timber G.

Economy of bulk shipments

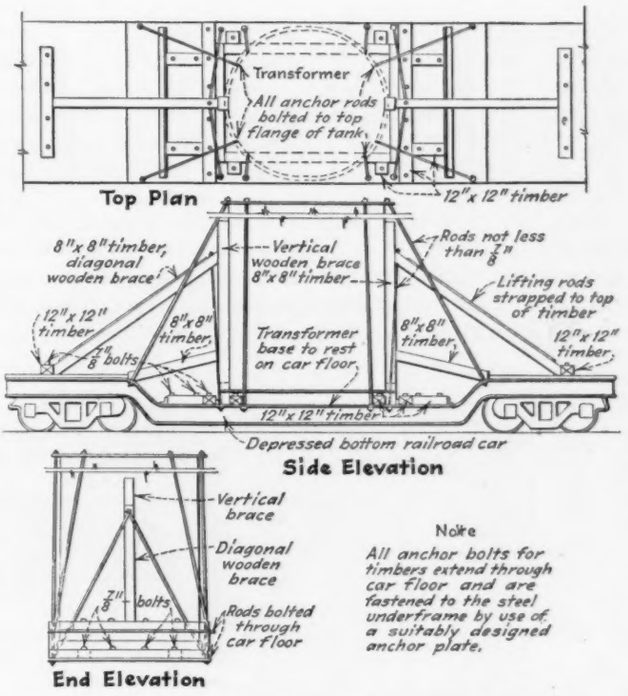
Bulk loading of copper busbars, rods or tubing means an appreciable saving compared with the old style of boxing a comparatively few pieces in individual crates in car-lot consignments.

that the best methods developed at the present time shall be employed in packing and loading the equipment for transportation. These methods are continually changing owing to developments in the arts of designing and constructing electrical equipment to meet modern requirements.

Acquaintance with the type and parts of the assembly and also with the fabrication of various products is necessary before substantial and economically designed containers can be produced. Packing and loading electrical apparatus covers a broad field because parts of large rotating equipment may weigh over 200,000 lb., while some of the delicate instruments weigh only ten ounces. A definite method or type of container design has been established which is used when preparing equipment for shipment. However, numerous difficulties have been encountered, among them the fabrication of both fragile and rugged construction in the same assembly of apparatus and the possibility of damage by condensation of moisture through exposure to the elements. In addition to these tangible transportation hazards, the limited clearances of bridges and tunnels is a source of much concern to those interested in the design of the larger-capacity electrical apparatus.

As long as the human element is included in the handling of containers and in the switching of cars during transit, irregularities and damage are likely to occur. Speed and carelessness in the rough handling of cars in transit are the principal factors which invariably cause damage. When cars collide, the reactive force increases at a much faster rate than a direct relation to the impact velocity would involve. At 2½ miles an hour the reactive force is approximately 630,000 lb. This point is illustrated in the picture showing the condition of a car of circuit breakers improperly loaded and roughly handled in transit.

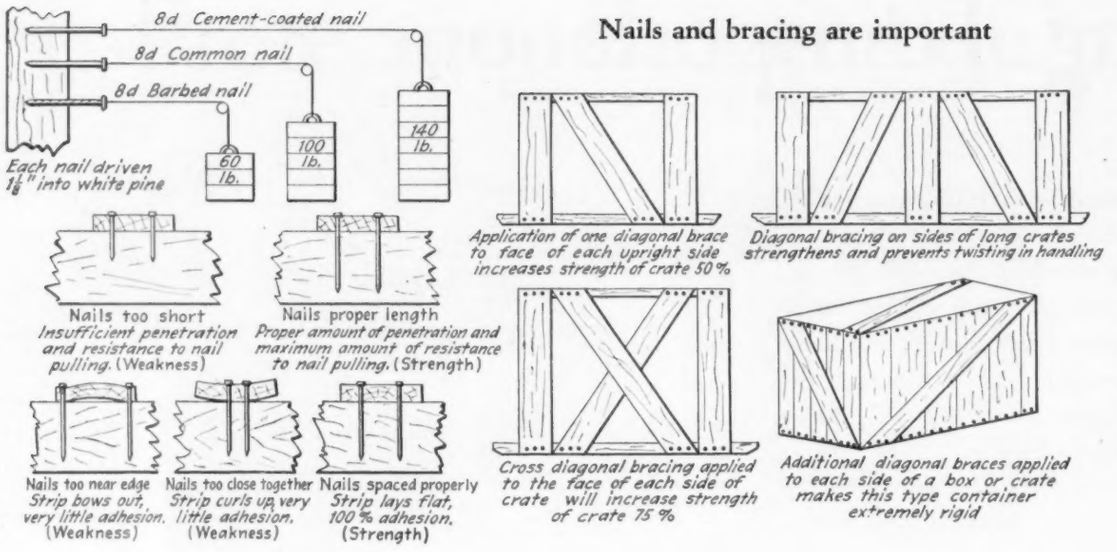
It is not to be expected in the ordinary handling of freight equipment during switching movements that the impact when coupling cars can be controlled to a degree which will not produce perceptible shock. But it is possible and practicable to regulate the speed of cars and


Transformer
All anchor rods bolted to top flange of tank
Top Plan
12"x 12" timber
8"x 8" timber, diagonal wooden brace
Vertical wooden brace 8"x 8" timber
Rods not less than ⅞"
Lifting rods strapped to top of timber
12"x 12" timber
8"x 8" timber
Transformer base to rest on car floor
8"x 8" timber
12"x 12" timber
⅞" bolts
12"x 12" timber
Depressed bottom railroad car
Side Elevation
Vertical brace
Diagonal wooden brace
⅞" bolts
Rods bolted through car floor
End Elevation
Note
All anchor bolts for timbers extend through car floor and are fastened to the steel underframe by use of a suitably designed anchor plate.

For depressed-bottom cars

Bracing and blocking of large transformers on depressed-bottom cars has been safely and economically accomplished by this method. The lowest possible overhead clearance is obtained. Shifting on the car floor is prevented, and the possible weaving of the top is eliminated by the application of this method of loading.

Nails and bracing are important


8d Cement-coated nail
8d Common nail
8d Barbed nail
Each nail driven 1⅛" into white pine
60 lb.
100 lb.
140 lb.
Nails too short
Insufficient penetration and resistance to nail pulling. (Weakness)
Nails proper length
Proper amount of penetration and maximum amount of resistance to nail pulling. (Strength)
Nails too near edge
Strip bows out, very little adhesion. (Weakness)
Nails too close together
Strip curls up, very little adhesion. (Weakness)
Nails spaced properly
Strip lays flat, 100 % adhesion. (Strength)
Application of one diagonal brace to face of each upright side increases strength of crate 50 %
Diagonal bracing on sides of long crates strengthens and prevents twisting in handling
Cross diagonal bracing applied to the face of each side of crate will increase strength of crate 75 %
Additional diagonal braces applied to each side of a box or crate makes this type container extremely rigid

The comparative efficiency of the holding power of nails illustrates their importance in crate construction. The spacing and the penetration in the wood into which they are driven have a bearing upon their resistance to nail pulling. A crate having a skid foundation should always be reinforced with diagonal braces.

engines so as to avoid heavy shocks, against which it is impossible to load or brace the lading adequately.

Crates and boxes are the containers in which most apparatus, merchandise and material are packed, handled and transported from point of manufacture or assembly to point of sale, distribution or use, and for this reason they deserve thought and study to arrive at designs and types that will be safe and economical. A considerable part of the loss and damage to crated consignments in transit can be attributed to the method of packing and the type of containers used. Proper spacing and length of nails play an important part in crate construction, as does also the diagonal brace applied to the face of the crate or box. When skids are used in crate construction, the apparatus must be bolted to the skid. Much can be accomplished to reduce damage in transit to a minimum by better packing and by the use on the sides of cars of placards reading "Do not bump this car. Switch and handle carefully."

In most cases it is impossible for the shipper to see the condition of a consignment upon its arrival at its destination. On the other hand, the purchaser has the privilege of inspecting the shipment before removal from the car or crate and is, therefore, in a much better position to specify what packing and loading methods are most satisfactory to reduce the losses in transit. He can profitably keep in mind the following points:

Steel strapping adds 25 per cent rigidity at less cost to the ordinary wooden crate, making it possible to use a lighter construction.

Wire-bound barrels or boxes withstand rough usage in transit.

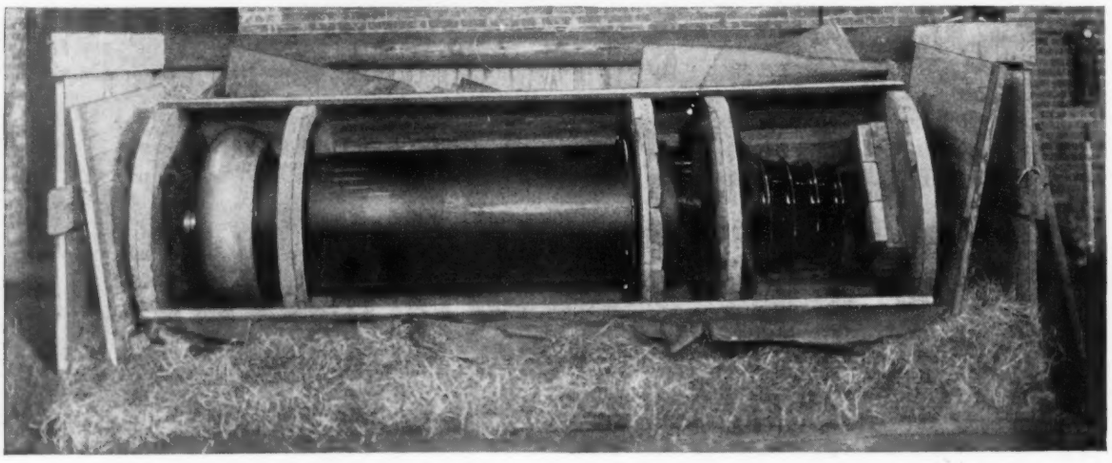
The all-steel cable reel will have an important place in future cable shipments.

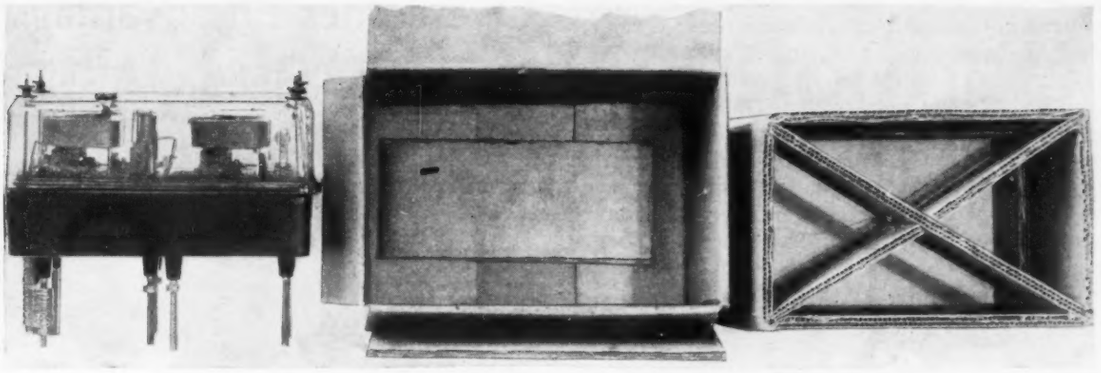
A new method of snubbing the skid on which a shipment is loaded and bolted absorbs shocks in transit and prevents damage to machinery weighing not in excess of 6,000 lb. This method uses side cleats close up to the skid and through which lag screws are driven, their points penetrating the side skid timbers neither less than nor more than 2 in. When impact comes the points drag along through the skids and thus absorb much of the shock.

To steady and anchor heavy and bulky loads on cars, a guy rod of suitable strength, placed at an angle of 45 deg., anchoring the load to the underframe of the car, has no substitute.

For special pieces, special treatment

Two consecutive shipments of this type of million-volt insulator, shipped in a vertical position, were received damaged before the floating packing illustrated was designed and used successfully. The insulator was cradled in a tubular case. Chipping or scarring of the micarta tubing or porcelain was prevented by the use of vellumoid and felt packing. This case was floated on an 18-in. cushion of excelsior and arrived safely at its destination.





Fiber containers prove satisfactory

Double-walled corrugated fiber board is used successfully and economically for instruments, insulators and small current and potential transformers. The mounting lugs, however, must not come in contact with the diagonal supports of the package assembly.

Semi-rigid loading presents an interesting study in the application of various types of bumpers and elevating trusses. Metal bands prevent upward thrust of consignment at time of impact.

Corrugated fiber-board is destined to be the shipping container of the future for small consignments. Containers of this material save time in packing, have a low first cost and reduce shipping and storage expense.

The reduction of loss and damage to freight by having it arrive in perfect condition is obviously to the advantage of the shipper, the carrier and the consignee. In an effort to minimize the hazards to which electrical apparatus is subjected in transit, it would be gratifying to all concerned in the electrical industry if co-operation could be received from the carriers by having them educate their personnel to the fact that more care must be exercised in transporting and in the switching of cars of electrical equipment placed in their hands for transportation.

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New Construction Practices Cut Rural Distribution Costs*

By NICHOLAS STAHL
Chief Engineer Pennsylvania Power & Light Company, Allentown, Pa.

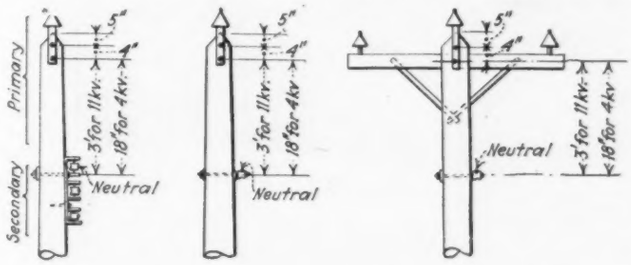
LOW cost and simplification in engineering and construction of rural lines may be effected by lengthening the spans, using shorter poles, adopting ridge-pin construction and combining the primary and secondary neutrals.

Specifications drawn up on that basis for rural line construction provide for long-span construction and the use of No. 2 bare steel-core aluminum conductors strung with a maximum tension of 50 per cent of the ultimate at railroad and public utility crossings. Where crossings are not involved, the maximum tension is raised to 60 per cent if it is found to be more economical. The average span is approximately 250 ft., with 450-ft. spans being used where the roads along which the lines are built are straight enough to provide straight-line construction for that distance.

Class D, 30-ft., open-tank, butt-treated chestnut poles are used for supporting the conductors, unless taller poles for clearances or stronger poles for angles or other special reasons are required. A ridge-pin type of construction is used, with the phase wire supported on a ridge pin at the top of the pole and the neutral wire 2 ft. or 4 ft. below.

In event three-phase primary wires become necessary, the additional conductors are carried on a crossarm mounted at the lower hole supporting the ridge pin. No satisfactory substitutes for crossarms have yet been found where polyphase circuits are involved.

The chief advantages of ridge pin construction for



Ridge-pin arrangement effects saving in rural line construction costs

The diagrams on the left show the arrangement of wire supports on the pole for single-phase construction. The diagram on the right shows how the ridge-pin, single-phase construction may be adapted to three-phase operation.

The neutral wire is supported on a porcelain spool insulator, which in turn is supported by a special bolt which allows the insulator to turn freely. Construction work may be facilitated by running out the wires, as strung, on these spools. The neutral wire serves as a common neutral for both the primary and secondary circuits, and it is grounded approximately every 1,000 ft. as well as at each transformer installation. When secondary service is installed a standard secondary rack is substituted for the spool insulation.

(1929)

Miles of ridge-pin rural line built			97.1
		4 Kv.	11 Kv.
1.	Number of miles of ridge pin construction analyzed	21.5	60.3
2.	Number of lines analyzed	27	13
3.	Average customers per mile of line analyzed	6.08	6.38
4.	Cost per mile of line analyzed		
	(a) Right-of-way and clearing	$173	$130
	(b) Primary	1,127	1,622
	(c) Secondary	510	624
	Total	$1,810	$2,376

Abstracted from a paper, "Simplification in Engineering and Construction of Rural Lines," presented at the annual convention of the Pennsylvania Electric Association.

single-phase lines are: Simplicity and strength minimum required horizontal and side clearances; reduction of probability of conductor short circuits; elimination of "overhang" permits; reduction of tree trimming for side clearance; complete pole framing and assembly before erection; elimination of crossarm maintenance; convertibility to polyphase circuits, with minimum labor and waste where metallic grounded neutral is used; maximum efficiency in use of material; clean cut and pleasing appearance; provision for a metallic ground throughout rural districts for both primary and secondary, thereby eliminating hazards resulting from poor grounds and facilitating the operation of protective equipment.

All long extensions or those expected to grow into long extensions are built for 11,000 volts, though in a few cases, where built for 11,000 volts, they are operated at 4,000 volts.

Experience with 11,000-volt rural distribution has been very good. One single-phase system is 27 miles long, and in another case more than 100 miles of line is fed from one substation.

Simplification of rural lines has resulted in reduction in costs of approximately 12 per cent, and this has been in the face of longer hauls to the point where the extensions have been built, as each extension is on the average further away from crew headquarters.

Overcomes Disadvantages of Usual Shielding Tape

By F. L. CARY
Transmission and Distribution Department, New York Edison Company

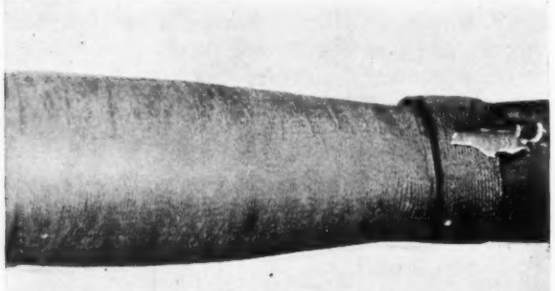
TWO materials that have been in general use for shielding high-voltage cable joints, namely, flattened tubular-woven copper braid and thin lead-foil ribbon, are both fairly satisfactory, but the copper braid is comparatively expensive and the lead foil is rather fragile. In their search for a better shielding material engineers of this company ran across a woven metal tape used in the dress industry. It consisted of cotton threads wrapped with silvered copper and was used principally for decorative purposes in women's dresses and millinery.

Working with the manufacturers, the engineers devised a tape of slightly different weave composed of unbleached and undyed cotton thread, each thread uniformly covered with a pure, unfinished fine copper ribbon. The threads are woven into a tape of about $\frac{3}{4}$ in. normal width and with a bias mesh.

The advantages of this tape are that it is easy to apply, solders readily, is thin and flexible, porous, low in cost and fits tightly over the joint near the lead sheath where it is most effective. Splicers are well pleased with the manner of handling the tape, because it is almost the same as applying another layer of insulating tape.

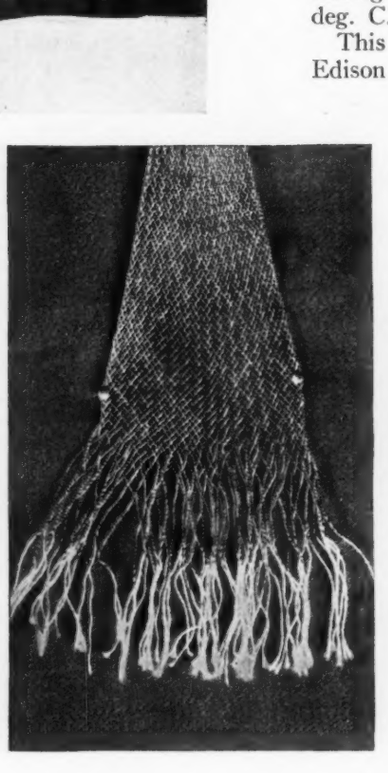
Since the tape is partly composed of cotton, it is necessary to exclude all moisture before applying it on cable joints. This is best accomplished by thoroughly boiling the tape in impregnating compound above 100 deg. C. just before putting it on the joint.

This new tape has been in use by the New York Edison Company since December, 1928.



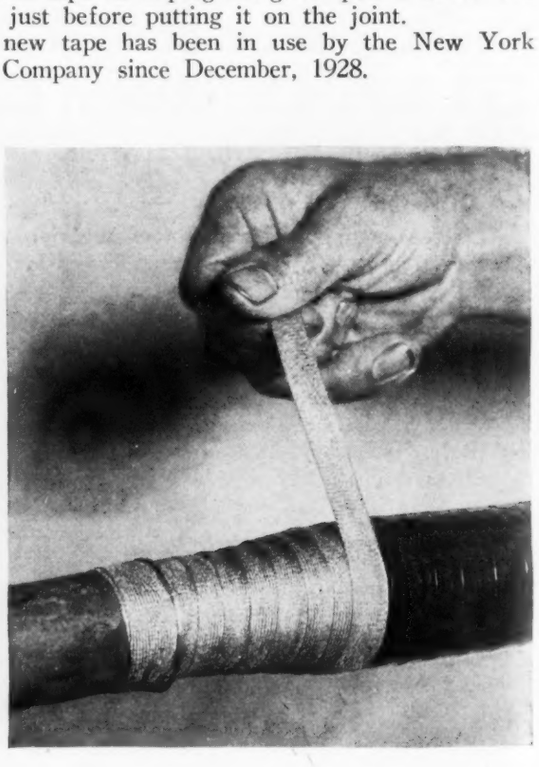
Tape completely shields joints

This tape is compactly wrapped about the joint. At each end it is inserted under the lead sheath, then carried over the sheath and spot-soldered.



Copper-mesh tape facilitates shielding of cable joints

This tape is composed of copper-covered cotton thread having a bias weave. It is almost as easily applied to joints as another layer of insulating tape.



Early Days in Transformers

An Interview with

REGINALD BELFIELD

By L. W. W. MORROW

REGINALD BELFIELD brought the first Gaulard and Gibbs transformer to America at the request of George Westinghouse and remained here until this device was perfected as a commercial product. In this interview he gives readers of *Electrical World* a glimpse of those interesting early days that formed the basis of the alternating-current system in America.

LUCIEN GAULARD was a Frenchman of the inventive type who developed the induction coil into a transformer called a secondary generator. This was an induction coil with a straight iron wire core and having a primary and six secondary coils surrounding the primary winding. A wealthy Englishman, John Dixon Gibbs, met Gaulard and backed him in the formation of an English company. This company applied the transformer to commercial alternating series circuits and installed several systems, notable among these being that of the lighting of part of the Metropolitan Railway system in London in 1883 with a circuit between 15 and 16 miles long. Gaulard and Gibbs stuck to the series idea and gained little commercial prominence, being eclipsed by the Westinghouse developments in this country and the Ferranti developments in Great Britain.

Most American engineers have only a vague knowledge of the early developments in transformers. Their knowledge is usually associated with the Westinghouse purchase of Gaulard and Gibbs patents and little tangible history is recorded of the details of this transaction. It was with great interest, therefore, that the author looked forward to an interview with Reginald Belfield, the man who worked for Gaulard and Gibbs and George Westinghouse and who brought the first transformer to America. He is a little known pioneer. When I met Mr. Belfield I saw a man of splendid figure and a polished English gentleman. He kindly answered all questions and recalled the early days of his career with the delightful humor and keen insight characteristic of the best type of English engineer and gentleman.

Not knowing where to start, I asked Mr. Belfield to relate his first experiences with Gaulard and Gibbs and the incidents leading up to his coming to America.

"I BECAME associated with Gaulard and Gibbs at the beginning of the year 1884. Previous to that time I had been working with Ferranti. I was the first trained electrical engineer to join him and I was engaged in developing his dynamo, his meter, and much of his other early work. But my health broke down and I had to leave him, in 1883. I was also the only trained engineer with Gaulard and Gibbs. Gaulard was no electrician, Gibbs knew nothing of the subject, and they had as their chief engineer a man who was a good mechanic.

"At the time I began work with Gaulard and Gibbs they had just formed their company and were starting their works in London, outside firms having done their work previously. The secondary generator which they were then using had been developed from Gaulard's original "Paris" model. It now consisted of a straight bundle of iron wires, around which was wound a No. 8 B.W.G. insulated cable as the primary, while the secondary was made of 48 wires, of No. 26 B.W.G., divided into six cables of eight wires each. This type was used for the Metropolitan Railway installation of 1883.

"Soon after this the next step in the development of the secondary generator took place. It now consisted of a series of punched copper rings, insulated from each other by paper soaked in shellac and mounted upon an insulated core made up of straight iron wires. Each ring was cut open at one point, or, in other words, was C-shaped, and each terminus of the C carried a tag which projected from the column. By means of these tags alternate rings could be connected together to form the primary and the secondary circuits. The secondary circuit was usually divided into two or more parts, which could be placed in series or parallel according to the secondary voltage desired. When in parallel the ratio of the primary voltage and that of the secondary was 2 to 1.

"During 1884 and 1885 further modifications were made in the design of the secondary generator. It was recognized that improved results could be secured by substituting a closed magnetic circuit for the straight iron core with open ends, so the iron wires forming the core were made a little more than double the length of the column and their ends were bent over and interlaced.

A still better arrangement, with a shorter magnetic circuit, was, however, soon adopted: Two secondary generators, each having cores of projecting iron wires, were placed side by side and the projecting core wires were then interlaced top and bottom, thus producing a closed ring of iron wire.

"In 1885 Gaulard and Gibbs supplied sections of the Inventions Exhibition in London with alternating current by a Siemens dynamo. The secondary generators consisted of the several types then standard with Gaulard and Gibbs, including secondary generators with straight cores, double generators with closed magnetic circuits, regulating generators with straight cores which could be pulled out to alter the secondary voltage, and also some very small wire-wound generators for midget arc lamps used for street lighting. The secondaries were arranged to supply individual groups of lamps, and in some cases, where the number of lamps was large, several secondaries were connected in parallel. But the primaries were all connected in series.

Series or parallel?

"At this time a controversy arose as to the advisability of connecting the primaries of the secondary generators in parallel. I had tried this method of connection and found that it worked exceedingly well. I found that, with a constant potential on the primary, the voltage of the secondary also remained constant and did not vary with the number of lamps supplied as it did with series connection. I further found that the best results with the series system were secured when the lamps supplied by the secondaries were connected in series, while with the parallel system the lamps should be connected in parallel.

"My experience with Ferranti made me fully cognizant of the great advantages possessed by the parallel system, and I urged Gaulard to drop the series and adopt the parallel system. He was, however, adamant and would not let me change over to the parallel system.

"In July, 1885, when the exhibition was half over, I found a new feature in the exhibit of the Edison Swan Company. Two transformers, invented by Zippernowski and Deri, were being exhibited there by Ganz & Company of Budapest. They were quite small and, consisting of a ring of iron wire on which the primary and secondary coils were wound, were practically the same as Faraday's first induction coil. They were connected with their primaries in parallel and each was supplying from its secondary a group of incandescent lamps also connected in parallel. This exhibit was a surprise to Gaulard in spite of the fact that the parallel connection of secondary generators had already been suggested to him.

"We may, I think, consider the fall of 1885 as the turning point in the history of the transformer. It had been evolved from the Rhumkoff coil, it had a closed magnetic circuit which was being made as short as possible, it could be connected in either series on parallel and it had been used on lighting systems, but it was not a practical commercial piece of equipment. That was to come through Mr. Westinghouse."

"How did Mr. Westinghouse come to be interested," I asked.

"As I understand it," said Mr. Belfield, "in 1885 Mr. Westinghouse had established his air brake and was interested in power transmission. One Sunday afternoon in this year he read an article in an English technical magazine describing the Gaulard and Gibbs system. He was interested and immediately arranged through an Italian friend, Guido Panteleoni, to get an option for the purchase of American patent rights. He ordered a complete set of the apparatus sent over, together with an engineer who was familiar with the system, and I was chosen to go to Pittsburgh, where I arrived in the fall of 1885. When the apparatus was received I set it up, with the help of my old friend Oliver B. Shallenberger, a brilliant electrical engineer who was in the personal employ of Mr. Westinghouse.

"As I have already pointed out, I had urged Gaulard to operate our secondary generators in parallel, and when I learned I was to go to America I redoubled my efforts in this direction, with the result that my written instructions were so worded that I felt at liberty to demonstrate the secondary generators with both series and parallel connections.

"The demonstration satisfied Mr. Westinghouse as to the possibilities of the system for power distribution, but he recognized—which I could not deny—that the secondary generators were not practical and could not be put on the market without completely redesigning them.

"Mr. Westinghouse very kindly invited me to stay with him at "Solitude," and every evening as long as I was there we discussed the possibilities of the system, its development and its future. He very quickly saw the possibilities of parallel operation and decided that it was the only method to be used commercially. He further saw that it was necessary to discard the particular design of the Gaulard and Gibbs apparatus and redesign the entire system afresh.

Machine production developed

"His practical mind instantly saw the necessity of employing mechanical methods of production instead of the laborious hand methods of Gaulard and Gibbs, and we nightly discussed how this could be done. I helped him all I could with my electrical and technical knowledge.

"The first point to be settled was the use of machine-wound coils. Then, as I insisted that the magnetic circuit be as short as possible and that the magnetic and electrical circuits be interlaced, it was decided that the coils should be surrounded by the iron core. This at once suggested to Mr. Westinghouse the advantages that would result from making the core of stampings of sheet iron instead of building it up with iron wires.

"It is remarkable how quickly Mr. Westinghouse grasped the salient points to be considered and how readily he supplied simple mechanical solutions for the difficulties that presented themselves. To work with him was a revelation to me, and I could not but admire the practical manner with which he dealt with mechanical details.

"The essential points of Mr. Westinghouse's transformer design are as follows:

Machine-wound coils with long sides, working in conjunction with a closed magnetic circuit.

Core of stamped iron plates insulated from each other and surrounding the coils so as to form a completely closed magnetic circuit.

"Mr. Westinghouse at once had a transformer built on these lines. We did not know how thin the iron plates should be to prevent eddy currents in them, so we

started with the thickest practicable plates and gradually used thinner sizes as we found it necessary.

"From my experience I knew that the limit of thickness to minimize eddy currents was in the neighborhood of 2 mm., and we therefore decided to make the first transformer with plates approximately this thickness, or a little thicker. This transformer worked well, but the iron heated badly. In a second, with thinner plates, the heating was not so pronounced.

"The form of the transformer thus being settled, it now became necessary to develop the alternating-current system. For this purpose Mr. Westinghouse employed William Stanley, a talented electrical engineer with a wonderful power of solving difficulties intuitively, to work out the details.

"By this time I had resigned my position with Gaulard and Gibbs and joined Mr. Westinghouse, and it was decided that I should work with Stanley at the laboratory Mr. Westinghouse arranged that he should establish for this purpose in Great Barrington, Mass. This was in December, 1885.

"Meanwhile, Stanley had become enthusiastic about the possibilities of alternating-current distribution and contributed largely to its development. Following Mr. Westinghouse's plan of having a core of stamped sheet iron surrounding the coils, he used several shapes of iron for building up the core, including E-shaped plates which could be inserted from opposite sides of the coils.

"In January, 1886, we installed the Siemens alternating-current dynamo, which I had brought from England, in the laboratory at Great Barrington, and then proceeded to make up several transformers differing in size, shape of plate, and form of winding, in order to secure data for making commercial apparatus. We had difficulty at first in getting sheet iron thin enough for our purposes and we bought up all of the ferrotype plates used for tintype photographs we could find and some of the early transformers were made with this metal. Subsequently, we secured satisfactory sheet iron, but we had to cut our plates by hand with shears and we insulated them with shellacked paper.

"The work developed so well that Stanley decided to light a portion of the village of Great Barrington, and this was successfully done, early in 1886, by installing transformers we had made with their primaries connected in parallel.

"Mr. Westinghouse, who in the meantime had formed the Westinghouse Electric Company, parent of the present Westinghouse Electric & Manufacturing Company, came to Great Barrington at this time to see our work. He was so pleased with it that he decided to transfer the manufacture of transformers to the Pittsburgh plant and start manufacturing on a commercial scale. Here Shallenberger and Albert Schmid took over our designs and put them into commercial shape.

"The first commercial alternating-current plant in America began operation at Buffalo, N. Y., in November, 1886, and this plant was soon followed by many others."

"How long did it take after your arrival to redesign and make a new transformer that embodied the ideas of Mr. Westinghouse, Mr. Stanley and yourself," I asked.

"It was about two weeks," Mr. Belfield replied. "Mr. Westinghouse was a man of action, he wished to have results quickly, and we worked at high speed."

Many interesting comments were made by Mr. Belfield about the early days and I left him full of gratitude that I had been able to see him and hear the fascinating story of the development of the transformer and the early days of the alternating-current system.

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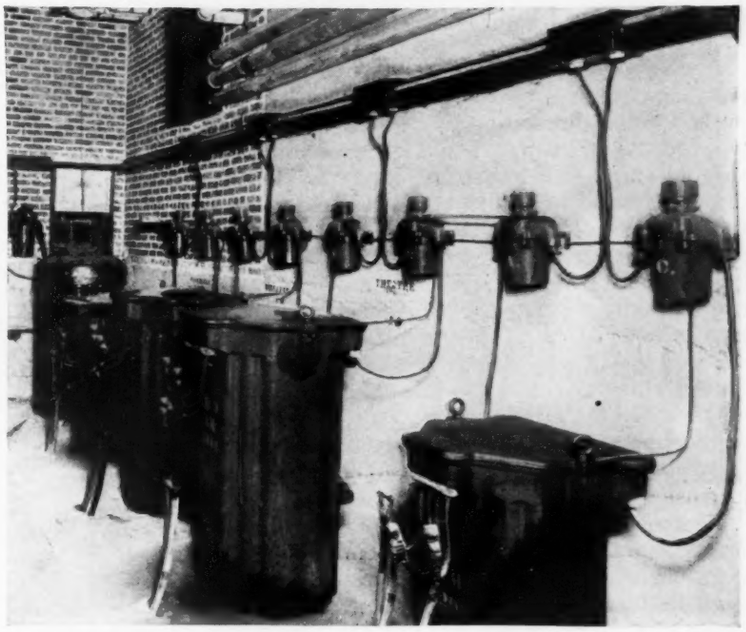
Metal-Clad 2,300-Volt Bus Replaces Open Runs



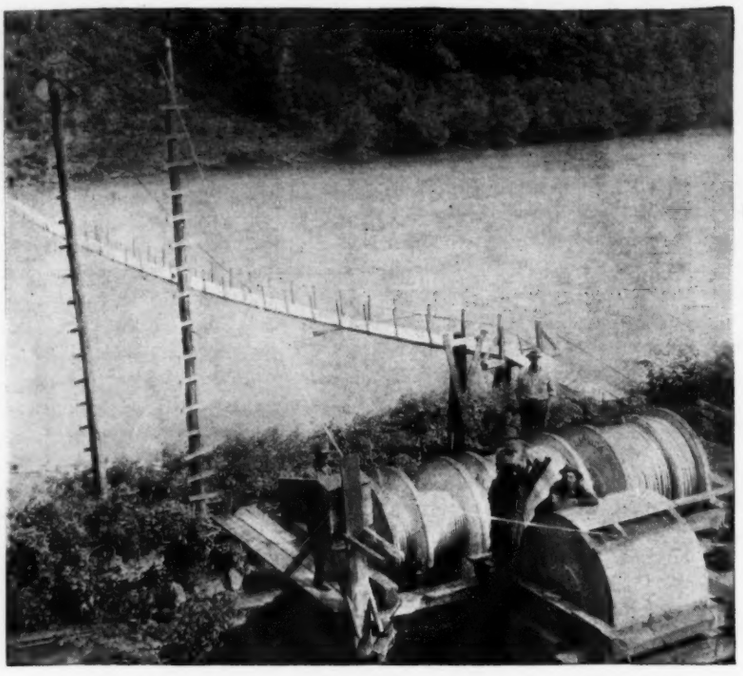
Greater safety, reduced fire hazard and a more workmanlike job have resulted from the practice by the Northwestern Electric Company, Portland, Ore., of replacing the usual 2,300-volt open bus in transformer vaults with a metal-clad bus as shown in the accompanying illustration. Conduit of ample size is placed on the vault wall, with 4 x 5 x 10-in. screw-cover pull boxes located directly above each transformer. Standard 2,500-volt, double-braid, rubber-insulated, stranded wire is used for the bus, with taps of the same wire to the 2,300-volt cut-outs and transformers. Corner turns are made with either a 4 x 5 x 10-in. screw-cover pull box or factory ell to avoid sharp bends and possible abrasion of the insulation on the wires.

In four years no installations of this type have given any trouble and are undoubtedly superior to the older open bus. The idea was originated by G. A. Drewett of the underground department of the Northwestern Electric Company.

Pulling Both Ends of 5,084-Ft. Span at Once

By J. ELMER HOUSLEY
Alcoa, Tenn.

WHEN the 5,084-ft. span of a 150-kv. line had to be erected across the gorge of the little Tennessee River near Alcoa, Tenn., by the Knoxville Power Company, it was found necessary to resort to a rather unusual method of stringing the conductors to avoid damage or splicing. Because of the steep hillsides and the presence of a railroad at the foot of one bank it was decided to have the cables delivered at the river level in the exact lengths required, but reeled in such a way that both ends could be fed to their respective terminal towers. This was accomplished by winding each cable at the factory on a special reel having a partition which divided the total amount of cable into two parts, proportional to the distance from the railroad to the respective towers.



Opposite ends of unspliced conductor being pulled toward terminal towers

As indicated by the accompanying illustration the two-part reels were set up beside the railroad and a portion of the long section pulled out first. It may be observed that this section was fed out through blocks on two nearby poles and then through other blocks hung at intervals from a suspension footbridge erected especially to facilitate this and other construction work at the crossing.

When the portion of the cable remaining on the long end of the reel equaled that on the shorter section pulling was started on the short end of the cable and both ends of the conductor drawn toward their respective towers simultaneously by lines attached to their terminals. By proceeding in this way both sections of the reel were emptied at the same time so the partition could be removed to release the cable. The cables were pulled to tension with a donkey engine.

The conductors consist of 500,000-circ.mil steel-reinforced aluminum cable, the core being double galvanized extra high-strength steel, $\frac{7}{8}$ in. over-all diameter, and weighs 2.032 lb. per foot. The steel core carries the entire load of the cable.

Details of making the dead-end connection are illustrated and described on page 810 of this issue of the ELECTRICAL WORLD.

The cores are socketed with zinc into open forged bridge sockets which are attached to a compression spring assembly, thence to an equalizing yoke. Connected to two triple yokes are six strings of twelve disk-type porcelain insulators. These insulators are of slightly higher strength than the insulators used on the standard portion of the lines. The assembly is connected to the tower with a turnbuckle fitted with jamb nuts to lock it in position. The aluminum strands are cut off in advance of the sockets and continuity of the conductor is provided by an aluminum casting which is compressed on the cable and a lug permits the bolting of a jumper terminal.

Four conductors are provided in each circuit with three cables in a horizontal plane and the fourth 20 ft. above. The latter is operated grounded normally, but in event of insulator damage it may be substituted for any line conductor by means of a simple bus arrangement, using the jumpers already in use.

There is a difference in elevation of the towers of 220 ft. At 80 deg. F. the sag below the lower support is 242.8 ft. for the lower conductors in the circuit recently built.

The corresponding tension in the latter is 19,075 lb. and in the upper 20,400 lb. The towers which support this 5,084-ft. span of cable weigh approximately 55,000 lb. each.

German Specifications Available

THE Verband Deutscher Electrotechniker announces that the following VDE regulations are available in foreign languages, including English, and may be obtained by addressing the association at Berlin W 57, Potsdamerstrasse 68. The numbers give the corresponding VDE designation:

452, rules for rating and testing electrical machinery.

453, rules for rating and testing transformers.

450 and 449, specifications for insulated power cables; specifications for sheathed cables.

403, specifications for lead cable for power transmission.

Lower Costs Desirable in System Investment?

Engineers have been racking their brains for methods of solving this problem, but no radical methods of effecting further economies have been forthcoming. A well-known engineer here indicates why the upward trend of system costs has not been retarded or reversed

THE statement is frequently made that an enormous volume of new business could be secured at attractive rates if we could reduce the initial investment. Many executives and commercial men seem firmly convinced that the investment can be materially reduced without appreciably affecting the quality of service rendered. It is even inferred occasionally that the average engineer is more interested in producing a highly specialized layout with all the latest and most elaborate refinements, rather than in extending the company's service at a profit to all concerned.

Every emphasis is placed on reducing the initial investment without a word on maintenance expense, or the cost of maintaining quality service.

Many of us know that one of the factors which keeps us from getting more new business is the low grade of service we are furnishing certain customers whom we took on under a rock-bottom estimate cut down to suit the commercial department. One of the largest metal-working plants in this part of the country developed its own power system after dissatisfaction with poor service from a certain power company near by. Range customers, particularly, require a high standard of service.

If we cannot get enough revenue from the prospective customer to give him the type of service he needs, we should quit trying to get his business. If we reduce the facilities in an effort to reduce the investment we will create trouble sooner or later for some one.

Nine out of ten complaints which reach the power sales department are passed back to the men who are responsible for operating the system and maintaining the equipment. These men ought to be given equal authority with the commercial men in deciding the investment that is justified in taking on new load.

It is not fair to say that the average utility engineer is anxious to design a highly technical, overcomplicated and highly automatic layout unless he thinks that the additional investment will improve service or reduce operating costs. We all know that equipment design is progressing rapidly and new improvements are on the market every day. We are continually preaching that machinery is better than labor, and yet some of our substations still use manual rather than automatic operation, whereas power companies ought to be the first to adopt electrically driven machinery.

Industrialists are continually being told that a higher investment will reduce labor costs; still the commercial departments work almost entirely on the basis of initial investment in deciding whether or not any new business is profitable.

Every engineer or department head who has to assume responsibility for maintaining service at a reasonable expense knows that there are many articles on the market of which "the best isn't good enough" for power company requirements. Most companies buy the best and highest priced high-tension fuses, storage batteries, control cable, line insulators, lightning arresters, etc., knowing that they get more for their money out of the best, but wishing that some one would design and build more reliable equipment, even at an increased price.

After all the grief we have had trying to get the manufacturers to build something good enough to give us reasonably continuous service, it is very discouraging to see executives accept engineering suggestions from commercial representatives, especially when these suggestions are directly opposed to all our past experience in improving service so that it can be produced and sold at a profit.

The facts should not be ignored by persons who have been most critical of engineers. On the other hand, no engineer worthy of the name will allow these obstacles to deter him in his search for economies. Remarkable accomplishments have been made in reducing production costs, but distribution costs still remain the largest portion of the total service cost, as in other industries. All the more reason for examining them most critically to ascertain where attention should be concentrated.

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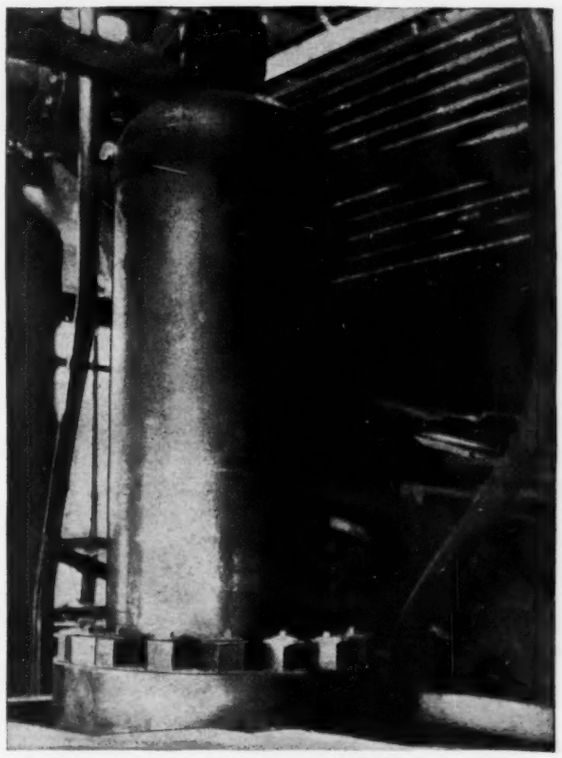
Constant Steam Temperature Insured by Desuperheater



Steam from the superheater in the 1,400-lb. pressure South Amboy station of the Jersey Central Power & Light Company passes through a submerged type desuperheater on its way to the turbines. This device insures a constant temperature of steam to the turbine at all loads. Automatic operation is provided as the desuperheater is under direct thermostatic control.

Welding a 14-Story Building

Nearly a mile of electric welds, consuming 6,120 kw.-hr. One thousand and fifty-four tons of steel welded. Average inches of weld per man per hour 47.4. Operators selected to qualify for this important undertaking.

By J. L. FADEN

Industrial Heating Engineer
Edison Electric Illuminating Company of Boston

MORE than 100 buildings of various sizes have been erected with the aid of electric welding during the past few years. Eighty-three municipalities have revised their building codes to permit the use of this noiseless and convenient method. The American Welding Society's code has recently been adopted by Pittsfield and Lynn, Mass.; Wilmington, Del., and Syracuse, N. Y. Birmingham, Ala., has adopted a miscellaneous code. Electricity is making rapid headway in this branch of structural-steel fabrication and erection, and when the Boston Edison company planned the erection of a new fourteen-story office building it was decided to weld the steel frame of the structure because it was felt that the method was economically sound and there was the added advantage of silent erection of the frame. Moreover, the use of arc welding permitted the company to help lead the way in a relatively new application of electricity.

The building is approximately 110 ft. long x 58 ft. wide and is 178 ft. high from the sidewalk to the top of the sign platform on the elevator pent house. It is believed that this is the tallest building to be erected up to date with the aid of electric welding. Although all of the field work was electrically welded, riveting was used in connection with the job work inasmuch as few fabricating plants are as yet equipped for shop welding. The use of riveting in shop work gave a number of establishments a chance to compete. The structural design was made to follow standard practice as far as the shop was concerned, using standard connections and customary clearances.

Special consent of city given to weld

The Boston building code does not specifically permit the use of electric welding in building construction; hence in order to carry on the work the Boston building commissioner, exercising his powers under the building law, allowed the work to proceed under a clause in the building code which permits the use of materials or methods not covered by the building law under such regulations as the commissioner may fix. In this case the company's consulting engineer certified by affidavit that the building, as far as the welding was concerned, conformed to the stresses and strains required by law. At the completion of the welding the consulting engineer certified by a final affidavit that the conditions agreed to had been met.

Although the building was designed primarily for office use, there were a number of different conditions with which compliance was necessary. The building actually covers two lots which are owned separately and taken by the company under long-term leases. Conditions in the leases require that the building be designed for any commercial use allowed by the zoning law. This necessitated, as far as the steel design was concerned, the use of 125 lb. per square foot of live loads on all floors, irrespective of the fact that only offices were contemplated above the second floor.

In addition the portion of the building on each lot had to be designed as a unit by itself with provision for a possible future party wall, stairs, elevators, ash hoists, boiler rooms, chimneys, etc.

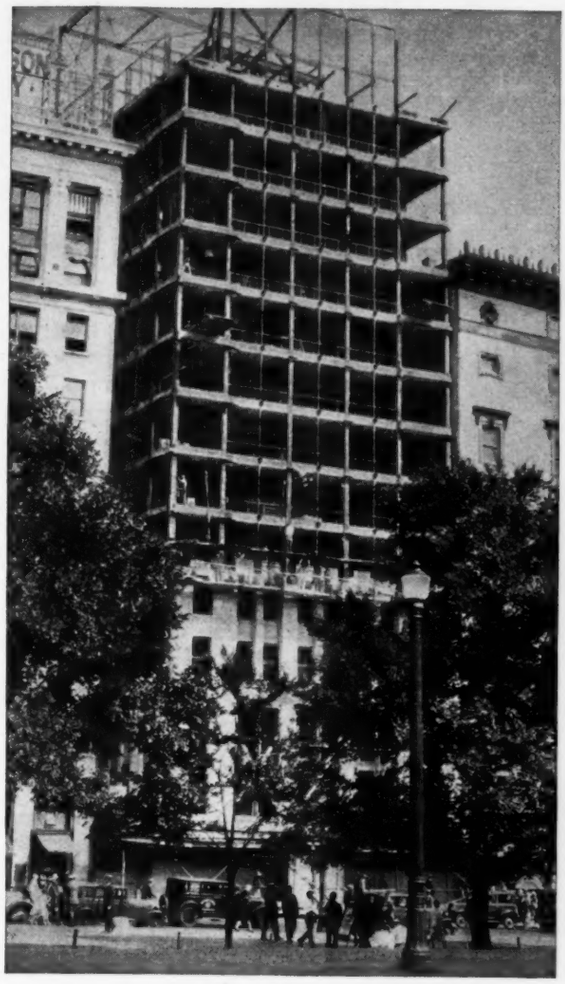
Business neighbors welcomed the absence of riveting noise as the structure rose

The welding work was handled under a sub-contract with a crew consisting of four welders and a foreman.

Inspection of each weld and the testing of welders was in charge of a man experienced in welding work. Daily reports covering the number of inches, size of welds and name of operator were made by the welding inspector.

The welders were required to pass the following qualification tests before they were permitted to work on the job:

Lap Welds. — A preliminary test was given which consisted of the preparation of two lap joints made of ½-in. x 6-in. x 8-in. plates. The first was welded in a vertical position and the second horizontally. After cooling, the specimens were broken at the weld by wedging at the unwelded 6-in. edge. For a satisfactory weld the fractured weld metal shows a bright, dense, even-textured, crystalline section, irregularly torn and void of iridescent colors; good fusion of weld and base metals; good penetration into the right-angle corner of the fillet.



Electric welding was used throughout the Boston Edison Company's new home

If a welder passed this test, he was subjected to tests on the preparation of fillet and butt welds. If he did not pass this first test, the expense and time of conducting the other tests were saved.

Out of the fifteen men who took the preliminary test, four passed. These four also passed the fillet and butt weld tests.

Fillet Welds.—The welders were required to make two test specimens of fillet welds—one in a vertical position and the other in a horizontal position. Each specimen consisted of two main plates, 4 in. x 1 in. x 12 in., placed in line, with their inner ends separated by ½ in. These plates were connected by two splice plates, one above and the other below the two main plates. Electrodes of $\frac{5}{32}$-in. diameter were used in welding. These specimens were tested to ascertain the longitudinal shearing value of the ⅜-in. fillet weld. The fractured specimens were examined for penetration into and fusion with the base metals and for freedom from gas holes or slag inclusions.

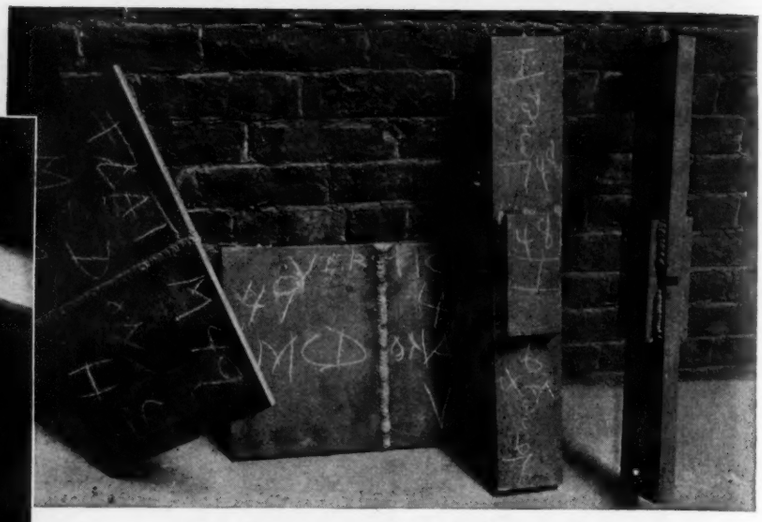
In order to pass this test the specimens had to show an average ultimate longitudinal stress of 44,000 lb. per square inch (11,700 lb. per linear inch). The lowest in the group had to show at least 38,000 lb. per square inch of minimum section of weld (10,100 lb. per linear inch).

Butt Welds.—The welders were required to prepare two sample butt joints, each made of two pieces, ½ in. x 9 in. x 12 in. One of these samples was welded in a vertical position and the other in a horizontal position.

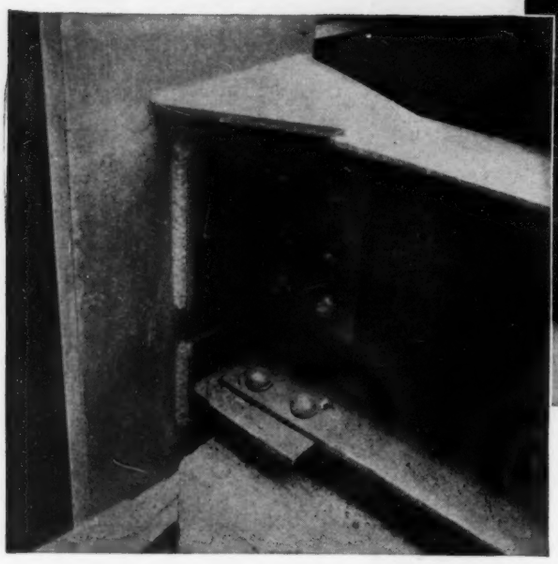
After welding, each sample plate was machined so that the joint was reduced to the thickness of the base metal. From each sample plate standard 2-in. tensile test specimens were made and tested in tension. The average tensile strength of each group had to be not less than 45,000 lb. per square inch, and the tensile strength of the lowest in each group had to be not less than 40,000 lb. per square inch.

NINE ADVANTAGES REALIZED BY ELECTRIC WELDING

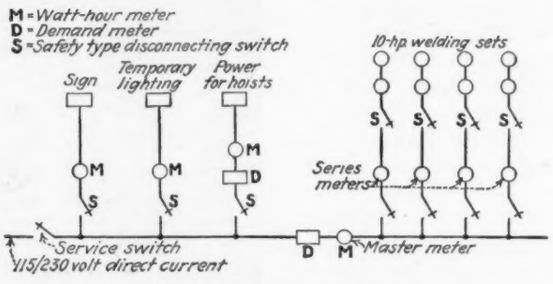
1. Construction noise virtually eliminated.
2. Cost of erecting and welding steel $3 per ton less than with riveted construction.
3. Accident hazard greatly reduced by absence of falling rivets. In another local construction enterprise where rivets were used serious trouble was encountered.
4. Fire hazard reduced by elimination of hot rivets.
5. Progress of welded construction equaled speed of riveting.
6. Welded building frame more rigid than riveted construction. The ordinary structural clearances allowed were not needed. Derrick work proceeded without shaking or swaying of frame.
7. Alterations made necessary by errors or changes are more easily made than with riveted structure.
8. Welding required simpler and less expensive stagings than riveting.
9. Smaller gussets are used for wind bracing with welded structure.



Test specimens electrically welded; fillet welds at right, butt welds at left

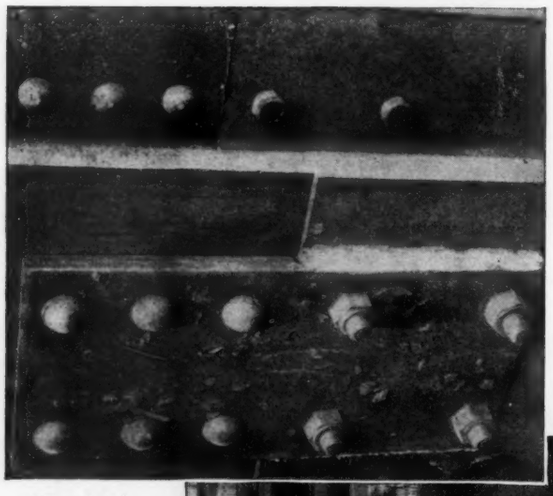


Typical column-to-girder connection

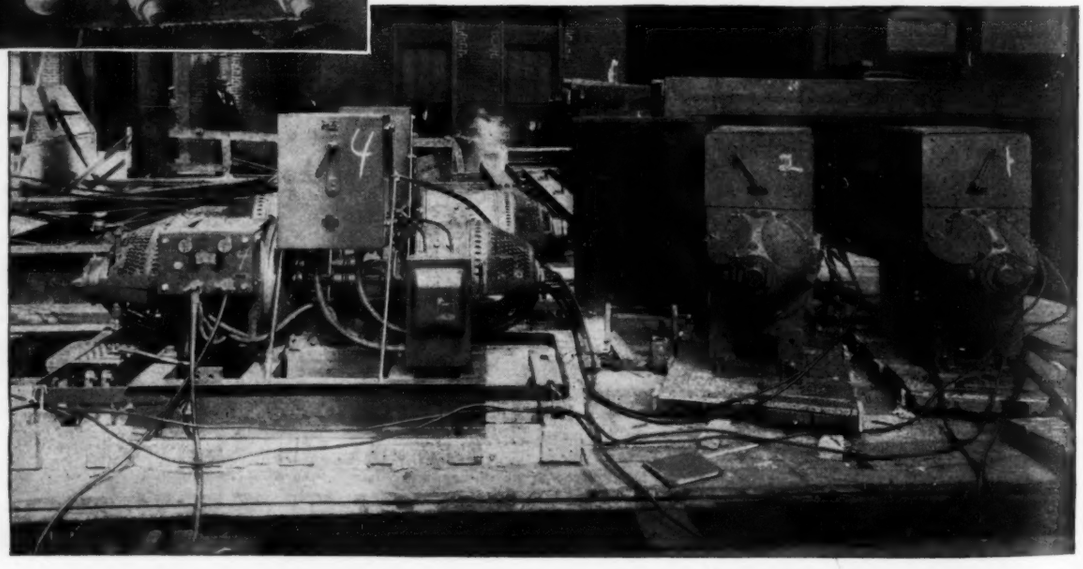


Every application of electricity on this construction job was separately metered

Four arc-welding sets consumed 6,120 kw.-hr. in welding 60,514 linear inches of steel in 1,280 welding hours. The maximum demand of the four 10-hp. sets was 32 kw.



Typical column splice



The upper left hand views on pages 826 and 828 show the method of attaching a girder to a column.

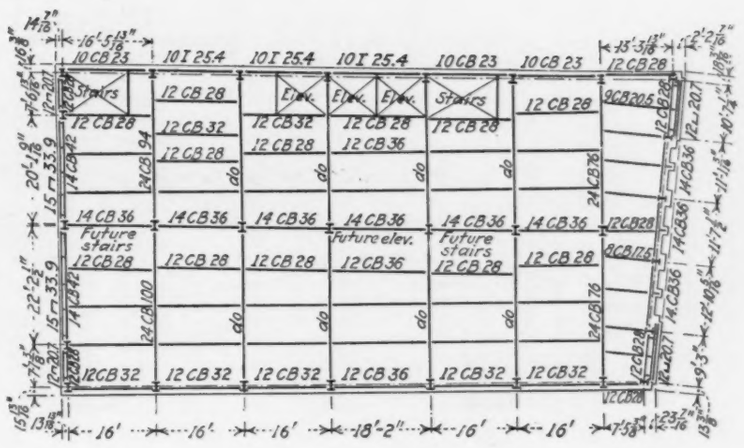
The girder is fastened to the column by two 10-in. x 4-in. x $\frac{1}{2}$-in. clip angles, one on either side of the web. These angles support the dead load carried by the girder, which in this case amounts to 57,000 lb. Twenty inches of $\frac{3}{8}$-in. weld are used, 10 in. on a side.

The wind stresses on the building which are transferred to this particular connection are taken care of by the upper plate, which is 10 in. x $\frac{1}{2}$ in. x 11 in. long, and the tee section, upon which the bottom of the girder rests. The plate is fastened to the column and girder by 10 in. of $\frac{3}{8}$-in. weld and the tee section to the column by 11 in. of $\frac{3}{8}$-in. weld, $5\frac{1}{2}$ in. on each side.

In design, 3,000 lb. per linear inch is allowed for a $\frac{3}{8}$-in. fillet weld for dead loads. Twenty per cent additional is allowed for stresses caused by wind loads, making an allowable value of 3,600 lb. per linear inch. In the computations $\frac{1}{2}$ in. is subtracted from the actual length of the weld to make allowances for the weld crater.

Electric service at 230 volts direct current was furnished the building for construction purposes. From this service the general contractor was supplied with a capacity of 95 hp., principally for the operating of a hoisting machine. Five kilowatts of lighting service was supplied at 115/230 volts. Four welding sets were used by the welding sub-contractor. Two sets were General Electric and two Westinghouse. Each of these sets was equipped with a 10-hp. motor operated at a normal speed of 1,750 r.p.m. The low-voltage side of the set which was used for supplying current for welding operated at a voltage of from 20 to 22 with an average current of 190 amp. The generator supplying this power was rated 200 amp. at 25 volts.

As soon as the steel had been erected to the first-floor level the four welding sets were placed on that floor and were left in this position during the entire time welding work was being done on the building. Under these conditions the maximum length that the welding leads had to be carried was approximately 175 ft. The welding



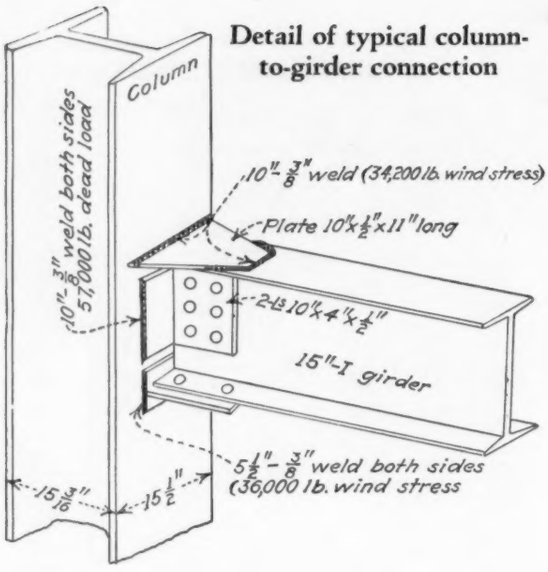
Typical floor framing plan

Summary of Welding Inspection Reports

Date	Total No. Inches Weld	No. Welders Working	Average No. Inches per Welder	No. of Floor Worked On
April 28	230.0	2	115.0	I
29	64.0	1	64.0	I
30	297.0	2	148.5	I
May 1	526.0	3	175.3	Basement
2	751.0	3	250.3	Base. and I
3	614.5	3	204.8	I and 2
5	1,216.0	3	405.3	I, 2 and 3
6	607.0	3	202.3	I, 2 and 3
7	866.0	3	288.7	I and 2
9	948.0	3	316.0	I and 2
10	692.0	3	230.7	I and 2
12	970.0	3	323.3	I, 2, 5 and base.
13	1,146.0	4	286.5	I, 2, 3 and base.
14	1,420.0	4	355.0	2, 3 and 4
15			Rain	
16	1,675.5	4	418.9	I, 2, 3 and 4
17	918.0	4	229.5	2 and 3
19	1,410.0	3	470.0	2, 3 and 7
20	1,670.0	4	417.5	3, 4 and 7
21	2,047.0	4	511.8	I, 3, 4, 5
22	2,156.0	4	539.0	4, 5
23	2,053.0	4	513.5	5, 6, 7
24	597.0	3	199.0	5, 6 and 9
26	304.0	3	101.3	I, 5, 6, 7
27	252.0	3	84.0	6, 7
28	2,176.0	4	544.0	6 and 7
29	2,073.0	4	518.3	6, 7
31	209.0	1	209.0	7
June 2	1,378.0	4	344.5	6, 7, 8
3	1,331.0	4	332.5	4, 7, 8, 11
4	1,482.0	3	494.0	8
5	2,078.0	4	519.5	6, 8, 9
6	1,572.0	4	393.0	3, 8, 9
7	446.0	4	111.5	I, 9, 10
9	585.5	4	146.4	I, 2, 3, 9, 10
10	1,688.0	4	422.0	4, 7, 9, 10, 13
11	1,792.0	4	448.0	9, 18
12	2,209.0	4	552.3	10, 11
13	2,448.0	4	612.0	11, 12
14	897.0	4	224.3	11, 12
16	1,467.0	4	366.8	12, 13
17	1,369.5	4	342.4	7, 13 and 14
18	275.0	3	91.7	9, 13, 14
19	1,726.0	4	431.5	13, 14, roof
20	1,761.5	4	440.4	13, 14, roof
21	907.0	4	226.8	13, roof
23	1,718.5	4	429.6	13, 14, roof
24	1,216.5	4	304.1	Machine penthouse
25	825.0	4	206.3	1, 13, 14, p.h.
26	526.0	3	142.0	Roof, marquise
27	1,489.5	3	496.5	Sign and marquise

Welding Data

Tonnage of steel in building		1,314
Tonnage of steel welded		1,054
Linear inches of welding		60,514
	In.	
$\frac{3}{8}$-in. fillet weld	51,921	
$\frac{1}{2}$-in. fillet weld	7,188	
$\frac{5}{8}$-in. fillet weld	1,405	
Pounds of welding wire		2,825
Lb.		
1,725	$\frac{1}{16}$-in. wire	
1,100	$\frac{5}{64}$-in. wire	
Maximum demand of welder group in kw		32
Kilowatt-hours of electricity for welding		6,120
Number of welding hours		1,280
Average inches of weld per man per hour		47.4
Average inches of weld per ton of steel welded		57.5
Average inches of weld per kilowatt-hour		9.8
Average kilowatt-hours per ton of steel welded		5.8



Detail of typical column-to-girder connection

Wind Load:

Top plate, weld (10 in. — ½ in.) = 9½ in., at 3,600 lb. = 34,200 lb.

Bottom clip, weld 2(5½ in. — ½ in.) = 10 in., at 3,600 lb. = 36,000 lb.

No. ⅞-in. rivets for bottom clip = 36,000/9,740 = 3.7. Use 4.

Dead Load:

Web clip, weld 2(10 in. — ½ in.) = 19 in., at 3,000 lb. = 57,000 lb.

No. ⅞-in. rivets = 57,000/10,000 = 5.7. Use 6.

Moment of connection = 34,200 × 2 = 68,400 lb.

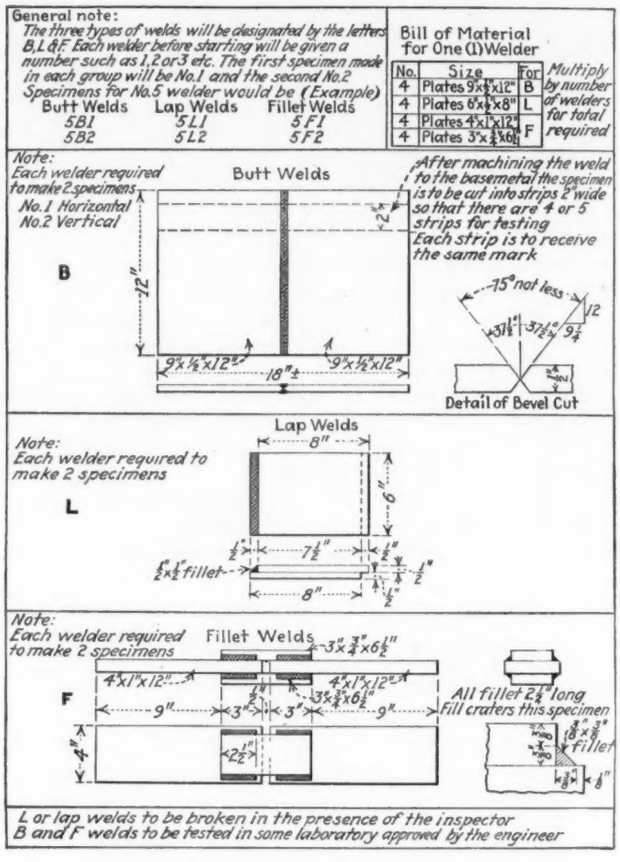
work began April 28 and ended June 27. During this time 6,120 kw.-hr. was used for welding, divided among the four sets as follows: No. 1, 1,133; No. 2, 1,309; No. 3, 1,604; No. 4, 2,074.

Three of the sets were separately metered, and the energy consumption of the fourth was obtained by subtracting the sum of the readings of the three other sets from the total consumption of all the sets as metered by the master meter.

Safety-type disconnecting switches were placed on all of the welding machines in accordance with the requirements of the Boston city wire department. The welding sets operated without any trouble and with no attention other than routine oiling during the entire time that the welding work was being performed. To meet labor union requirements, it was necessary to have one man stationed at the welding sets, although this was not essential from point of view of operation.

Of welding wire 1,725 lb. of $\frac{5}{32}$-in. diameter was used and 1,100 lb. of $\frac{3}{16}$-in. wire. The $\frac{5}{32}$-in. wire was used in making ½-in. welds and the $\frac{3}{16}$-in. wire for ⅝-in. and ¾-in. welds.

For the greater part of the job four welders were employed. A total of 60,514 in. of welding was made. On the basis of the whole job, the average number of inches of welding per man per hour was 47.4.


General note:
The three types of welds will be designated by the letters B, L & F. Each welder before starting will be given a number such as 1, 2 or 3 etc. The first specimen made in each group will be No.1 and the second No.2
Specimens for No.5 welder would be (Example)
Butt Welds 5B1 5B2
Lap Welds 5L1 5L2
Fillet Welds 5F1 5F2
Bill of Material for One (1) Welder
No. Size For
4 Plates 9"x½"x12" B
4 Plates 6"x½"x8" L
4 Plates 4"x1"x12" F
4 Plates 3"x½"x6½"
Multiply by number of welders for total required
Note: Each welder required to make 2 specimens
No.1 Horizontal
No.2 Vertical
Butt Welds
After machining the weld to the basemetal the specimen is to be cut into strips 2" wide so that there are 4 or 5 strips for testing
Each strip is to receive the same mark
B
12"
2"
9"x½"x12"
18"±
9"x½"x12"
75° not less
Detail of Bevel Cut
Lap Welds
Note: Each welder required to make 2 specimens
L
8"
6"
7½"
½"x½" fillet
Note: Each welder required to make 2 specimens
Fillet Welds
3"x¼"x6½"
F
4"x1"x12"
9"
3"
All fillet 2½" long
Fill craters this specimen
4"
2½"
L or lap welds to be broken in the presence of the inspector
B and F welds to be tested in some laboratory approved by the engineer

Specimens for qualifying electric welders

The importance of the installation, and, above all, the newness of the art applied to large-scale urban work, necessitated rigorous selection and training of operators.

CARSON & CARSON
ENGINEERS
22 SOUTH 15TH STREET, PHILA.
FRANK P. McKIBBEN
CONSULTANT

Day Monday Job No. W-102
Date 4-28-30 Report No. 1

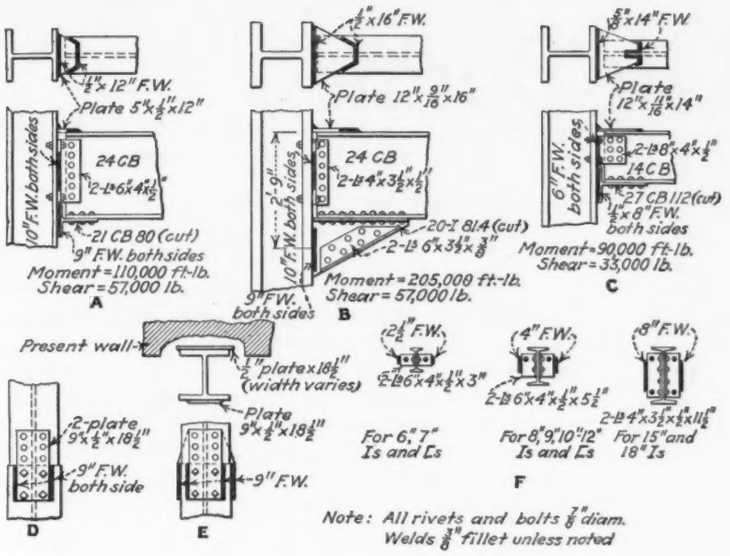
WELDING INSPECTION REPORT

Location Floor	Col.	Face A	B	C	D	Total	Welder	Remarks
1						8"	A	#56 - #22
1						8"	"	#47 - #22
1						4"	"	#48 - #22 Not complete
1						8"	B	#63 - #23
1						8"	"	#63-A - #23
1	13	30.5		30.5		61"	"	Face C - 25" weld Incomplete
1						8"	"	#65 - #7
1						8"	C	#66 - #7
1						8"	"	#46 - #7
1						8"	"	#62 - #24
1						8"	"	#63 - #24
1						8"	"	#63-A - #24
1	16	30.5		30.5		61"	"	Face C - 25" weld Incomplete
1						8"	"	#65 - #8
1						8"	"	#66 - #8
1						8"	"	#66 - #8
				Total This Sheet		230"		

Wire used Roebling 5/32
Welding Contractor Leake & Nelson Co.
Prev. Ously Reported 0
Total This Sheet 230
Grand Total 230

William M. Holmes
Inspector

Daily welding inspection report used on the Boston job



Details of steel framing showing variety of joints and welding required

It is interesting to analyze the progress of the work on certain days. On June 13, in eight hours, for instance, operator A welded 738 in., operator B 607 in., operator C 722 in., and operator D 381 in. The total number of inches for the day was 2,448 in., or an average of 612 in. per man per day. Of the total of 2,448 in. of welding, 2,235 in. was ⅜-in. weld, 99 in. was ⅝-in. weld and 114 in. was ½-in. weld.

On June 12, in eight hours, operator A welded 625 in., operator B 666 in., operator C 483 in. and operator D 435 in. The total number of inches for the day was 2,209 in., or an average of 552 in. per man per day. Of the total of 2,209 in., 2,086 in. was ⅜-in. weld, 120 in. was ½-in. weld and 3 in. was ⅝-in. weld.

On the occasion of making the first electric weld on the frame of the building, about 200 guests were invited, these being local architects, engineers and others interested in building construction. Speeches were made by President C. L. Edgar of the Edison company, Mayor James Curley of Boston and Prof. Frank P. McKibben, consulting engineer. The first weld was made by Mayor Curley with the aid of one of the welding operators who was already on the job. During the exercises a single rivet was driven in one of the erection bolt holes to demonstrate the difference between welded and riveted construction.

In the first week, as the welding of the building frame got under way, an exhibit was placed in the show window of the company's main appliance store. This consisted of various pieces of welded steel, photographs of buildings which had been welded, welding electrodes and masks and other related equipment. An advertisement featuring the electric welding of the building was run in a number of the Boston newspapers. In order to call the attention of those passing by the building to the fact that it was being electrically welded, a 6-ft. x 10-ft. illuminated sign was placed on the front of the building with the following wording: "The steel frame of this building is being joined by electric welding, a silent, safe and economical method."

Results of Qualification Tests for Welders

Fillet Welds

Mark	Yield Point, Pounds	Maximum Load, Pounds
J.V. 48	117,000	140,500
J.H. 48	114,000	130,200
M.V. 49	112,000	132,900
M.H. 49	112,500	123,500

Failure of Fillet Welds

J.V. 48	One weld at throat, one at parent metal
J.H. 48	One weld at throat, one at parent metal
M.V. 49	Two welds at parent metal
M.H. 49	Two welds at parent metal, one at throat and one-half and half

Butt Welds

Mark	Yield Point, Lb.Sq.In.	Tensile Strength, Lb.Sq.In.	Elongation, Per Cent of 8 In.	Fracture
J.V. 48	34,300	54,100	10.5	In weld
J.V. 48	34,700	55,200	21.9	Outside of weld
J.V. 48	35,100	55,400	23.3	Outside of weld
J.V. 48	34,000	53,200	9.4	In weld
J.V. 48	33,100	53,500	11.3	In weld
J.H. 48	32,300	47,200	6.3	In weld
J.H. 48	32,400	52,500	12.8	In weld
J.H. 48	33,100	43,700	4.4	In weld
J.H. 48	33,000	51,100	10.6	In weld
J.H. 48	32,600	45,200	5.6	In weld
M.V. 49	34,100	54,100	23.8	Outside of weld
M.V. 49	33,900	54,200	14.8	In weld
M.V. 49	34,500	54,900	25.1	Outside of weld
M.V. 49	34,500	53,000	12.5	In weld
M.V. 49	34,600	54,700	19.0	Outside of weld
M.H. 49	35,400	56,000	23.8	Outside of weld
M.H. 49	35,000	55,900	22.5	Outside of weld
M.H. 49	33,900	54,200	11.3	In weld
M.H. 49	33,600	56,500	22.5	Outside of weld
M.H. 49	34,400	55,900	21.3	Outside of weld

▼ ▼ ▼

Pole Top Fires Eliminated by Use of Aluminum Paint

POLE top or crossarm fires on electric transmission systems operating at tensions in excess of 6,000 volts may be successfully eliminated by the application of a special aluminum paint to pole tops and crossarms, according to W. H. Meyers at the second World Power Conference.

Current as small as 1 milliampere at potentials as low as 6,000 volts will, under suitable conditions of concentration of current and dryness of timber, char the surface of pole tops or crossarms and ultimately cause them to burst into flame. Small currents of this magnitude will leak over sound porcelain insulators of quite safe normal flashover value when light rains occur or misty conditions exist after periods of prolonged dry weather, particularly in a salt-laden atmosphere. Such conditions, however, are taken care of when the poles and crossarms are painted with aluminum paint.

The composition of the paint is as follows: One gallon of aluminum paint, one gallon of gray paint, four gallons of linseed oil and 21 lb. of plumbago.

Self-Restraint in Business*

By CLARENCE L. COLLENS

President National Electrical Manufacturers' Association

THE flagrant disregard of some of the principles upon which our American institutions are founded has gradually developed into legislation which places definite legal restraint on business, all tending to prevent monopoly, to promote and preserve the competitive system and under the competitive system to make business fair both to all competitors and to all consumers.

Even under these legal restraints, competition may be either ruthless and ruinous or intelligent and economic, for our laws are merely concerned with one side of the economics of business, namely, protecting the purchasing public from artificial enhancement of prices, but in no way protecting any industry from the ruinous prices of one or more competitors.

Ruthless, ruinous competition represents the perversion of individual liberty and does not bring to the inherent right of the individual to do business, or to individual initiative and intelligence, the reward to which business is properly entitled and which it has never been the intention of the law to destroy. Competition cannot become fair and economic unless to the legal restraints which are recognized as necessary is added the idea of *self-restraint*. Just as in the ideal social order, so also in the ideal business world, competition requires no laws and functions properly with due regard to the interests and rights of all parties concerned, because it is intelligent, self-governed and self-restrained. Voluntary self-restraint in respect to one's actions, for the reason that the course decided upon appeals to the judgment and intelligence, is always more acceptable than to have some outside power make a given course of action compulsory.

In many industries where competitive conditions are unhealthy it is not a change in law that is required to cure the disease, but rather a change of heart and the development of mutual respect and confidence. There must also be a sincere desire on the part of each executive to recognize a definite responsibility to the industry in which he is engaged, to be better informed regarding the motives and policies of his competitors, and the facts of the market situation, to use his liberty of action wisely and to exercise intelligent self-restraint in the conduct of his own business. Without such a change of heart on the part of many business executives, unhealthy and destructive competitive conditions cannot be improved.

Recognizing all legal limitations and acknowledging these as necessary and desirable, what liberties do I have under the competitive system and what self-restraint am I willing to impose on myself in doing my share toward promoting intelligent economic competition in the industry in which I am engaged?

**From an address before National Electrical Manufacturers' convention, Old Point Comfort.*

The competitive system does not presuppose or require lack of accurate knowledge regarding current market conditions or the price schedules of one's competitors.

Basing individual price policies on trade rumors, statements made by buyers, and indirect information which in many cases is misinformation, is not required by law and is one of the principal causes in developing an uneconomic competitive situation.

I prefer that my competitors know directly from me where I stand and am willing to place that information in their hands.

The above relates to such products as I regularly list. There are always "specials" whose price cannot be determined by published information. If it is my right to distribute published current market information, I feel it is also within my right to advise any other competitor of the facts regarding any current transaction involving specials and, if he is willing to give me that information, to receive from him the facts regarding his quotation on the same transaction. In respect to standard competitive products, it is usually some market leader who sets the pace. But any competitor may be the first in the field with a "special," and it is, therefore, even more important that in respect to specials I observe the policy of basing price on accurately determined costs plus a fair margin of profit.

A liberty which many desire to have is that of "price cutting," but no competitive industry can be healthy and economically sound where price cutting is prevalent.

Price cutting, that is, deviation from one's established prices, is unfair both to one's competitors and to other purchasers who under similar conditions have not enjoyed a price cut.

Disguised under the legal permissive qualification of "necessary to meet competition," it is in many cases deliberate or is based on misrepresentation or inaccurate information of the competitive situation and as such, is illegal price discrimination.

Its ultimate effect is substantially to lessen competition by means of the elimination of the weak. This is the phase of competitive relations where self-restraint counts most, and in the interests of both the purchasing public and my competitors I am willing to pledge myself to maintain a firm price policy, and whenever I feel that price changes by me are "necessary to meet competition," I will effect the change, not by a price cut on an individual negotiation, but by a general adjustment in my price schedules to be enjoyed by all my customers and with the usual publicity to the trade.

It is also my right to introduce any commercial practice in the conduct of my business which in my opinion

IN A competitive system it is my right to determine my own price policies and price schedules. It is also my right or within my control:

1. To distribute my established price schedules freely to both my competitors and my customers.

2. To make my price schedules simple and definite, easily understood by both my competitors and my customers.

3. To eliminate all secret rebates or any other form of price concession not clearly and definitely indicated on my published schedules.

4. To base my price schedules on accurately determined costs plus a fair margin of profit, or to follow the price policies and price schedules of a market leader if my own interests and those of the group are in my judgment best promoted by so doing.

will give me a competitive advantage. Here again intelligence and self-restraint are absolutely necessary. Each executive must bear in mind that any price or any practice introduced by him to gain individual competitive advantage, if it proves effective, will be followed by his competitors, or his competitors may even go him one better, the individual advantage being then lost. It is rivalry in introducing ways and means of gaining individual competitive advantage that reduces many industries to unhealthy conditions. I will not introduce any price or commercial practice to gain individual commercial advantage which if followed by my competitors generally would be uneconomic or commercially unsound. Examples of such practices are extension of terms of payment beyond those generally recognized, too liberal guarantees, consigned stocks out of all relation to the possibilities of business, excessive entertainment of customers, secret rebates or other concessions not shown in published price schedules, price differentials not justified by one's competitive position in the industry, etc.

And now to a liberty which some might deny

I feel it is my right to meet with my competitors as a group and discuss freely and frankly the economics of our industry and competitive practices which are unfair, destructive or unsound from a broad business standpoint.

Such meetings do not imply illegal understandings or agreements. I will not be a party to such understandings and reserve for myself absolute freedom of individual action and the right to make and change my individual decisions at any time. Are such meetings necessarily in restraint of trade? We are told that it all depends on the result or effect of the meeting.

To be in restraint of trade, irrespective of the results or effects, I feel it must be definitely proved that there was restraint to any executive's freedom of individual action in the control of his business, that the decisions of some individual executives were influenced by threats or the fear of reprisals, that there existed a moral obligation to follow some recommendation made, or that such meetings were used as a cloak to exercise arbitrary, monopolistic powers in respect to prices. If such meetings permit me to conduct my business more intelligently, with a more accurate knowledge of the competitive situation, and with greater fairness both to my competitors, my stockholders and my customers, or to make decisions in respect to my individual policies which assist in eliminating unsound commercial practices, I am not infringing any of the basic principles of a competitive system or of the laws which have been set up to protect that system.

A pledge to competitors

To summarize, I make the following statement and pledge to my competitors:

I indorse the competitive system and reserve for myself entire freedom of individual action and the right to make and change at any time my decisions in respect to prices and competitive practices. Recognizing, however, a definite individual responsibility to the industry in which I am engaged, I pledge myself:

1. To make my published price schedules simple and definite, capable of easy interpretation and administration, and to refrain from all secret rebates or other secret concessions affecting prices or terms and conditions of sale not clearly indicated in my published schedules.

2. In respect to all products which are generally competitive to keep my price schedules in proper economic balance with the current market situation.

3. In respect to "specials" to base my prices on accurately determined costs plus a fair margin of profit.

4. To distribute my published price schedules generally to my competitors and to the trade.

5. To maintain a firm price policy and only effect price changes by a general change in my published schedules.

6. To give promptly to any other executive such facts in relation to my prices and price schedules as will assist in correcting any misinformation which might otherwise exist as to the competition which I am giving the rest of the industry.

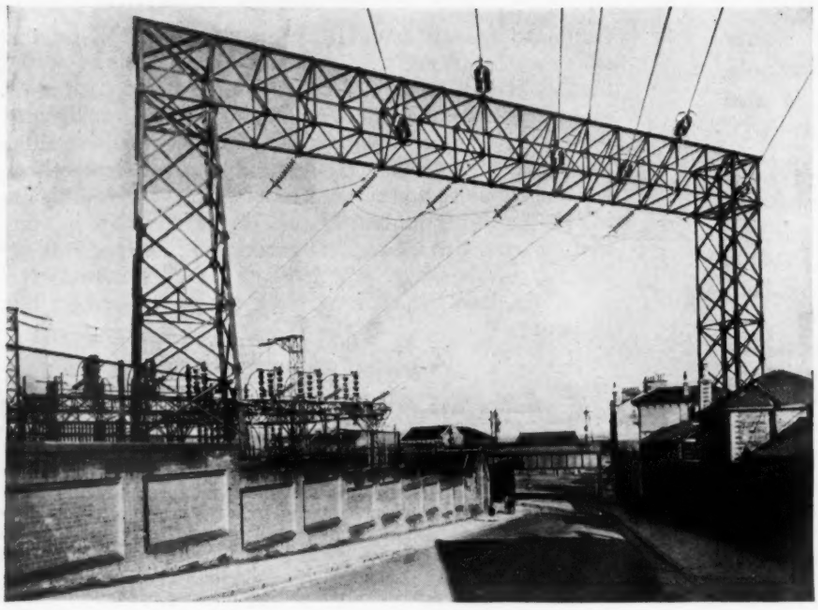
7. To base my decisions in respect to competitive practices on established facts and to give no credit to rumors, or to incomplete or indirect information regarding the practices of my competitors.

8. To refrain from introducing any practice to gain individual competitive advantage which if followed by my competitors generally would be uneconomic or commercially unsound.

This is the platform on which I stand in the conduct of my own business, as far as any action by me affects the interests of the industry in which I am engaged. If each executive in a competitive group will be as frank in advising the public and his competitors as to just what his policies are, competition will be none the less keen, but it will be saner, more intelligent and more economic. It merely eliminates guesswork, rumor and misinformation as a determining factor in price and price policy decisions. Reserving entire freedom of individual action, an executive in control of an individual business in a highly competitive group, is certainly entitled to such facts as are necessary, and, in fact, to all the facts that are necessary, for the intelligent conduct of his individual business.

Such a program does not negative the law of supply and demand and adjustments in price levels will still follow the competitive demands of that law and any basic changes in cost, but under any conditions of supply and demand or of cost, prices will be more stable. It is the American plan of price stabilization based on freedom of individual action, influenced only by publicity, accurate facts, intelligence and self-restraint.

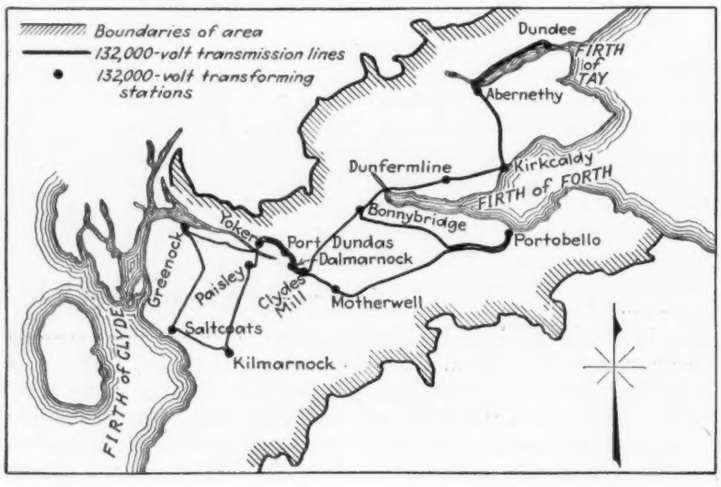
Scots Wha Electrically



Greenock substation and trestle

SCOTLAND took her place in line with the advance of electricity when, some months ago, the British Minister of Transport officially opened at Portobello on the Firth of Forth, near Edinburgh, the "Central Scotland Electricity Scheme." The plan followed to prepare for the intensive electrical development of North Britain was along the same lines that were pursued in laying out the "grids" that are now in various stages of completion for England and Wales. The area to which it relates is about 4,980 square miles in extent and has a population of approximately 3,750,000. It embraces shipbuilding, engineering, coal-mining and steel industries.

The main transmission lines cover 246.6 route miles, of which 187 miles is single-circuit and 59.6 miles double-circuit. They connect the generating stations at fifteen points—Carolina Port (Dundee), Kirkcaldy, Townhill (Dunfermline), Bonnybridge, Portobello (Edinburgh), Motherwell, Clyde's Mill, Yoker, Stonebyres and Bonnington (Lanarkshire), Dalmarnock and Port Dundas (Glasgow), Blackhall (Paisley), Kilmarnock, and Dellingham (Greenock). Two new power stations are contemplated — one in the east and one in the west of the area. Within the area served by the scheme there are 42 electric organizations, eight of which own the station listed.



Central Scotland electricity scheme

Transmission is at 132 kv., and the main transmission lines are laid out in the form of ring mains, so that alternative sources of power are available in the event of a breakdown. The selected stations are in most cases in close proximity to the principal load centers. Consequently the major portion of the load generated at these stations, particularly during the months of maximum demand, will be absorbed in the distribution systems of the organizations owning the stations mentioned. The grid will make available to any plant the large aggregate of reserve power contained in all these selected stations. Central control of the grid will be exercised from the Dalmarnock substation at Glasgow.

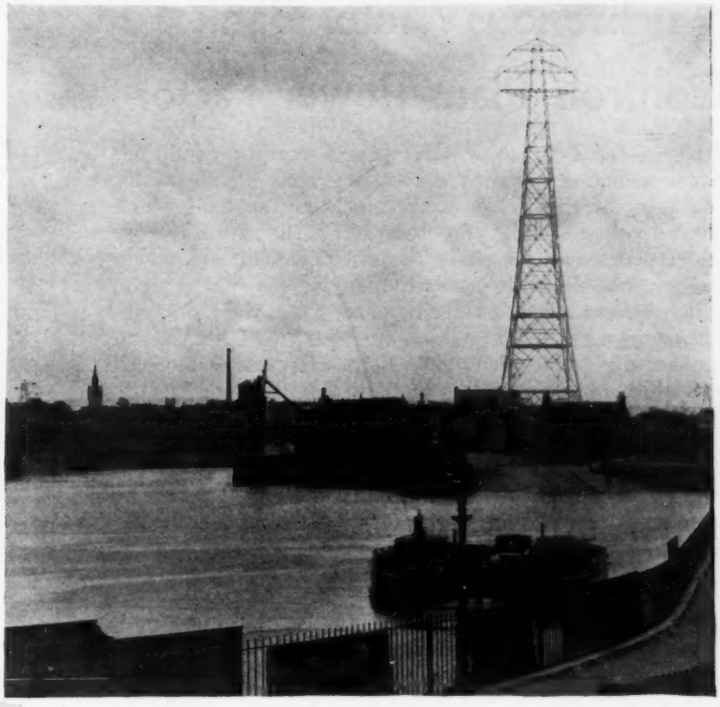
River crossings proved an important factor in building the system. At Paisley, where there is much shipbuilding, the required clearance of 186 ft. above high-water mark necessitated towers 218 ft. in height. At Renfrew the Clyde is crossed by means of towers 275 ft. and 283 ft. in height with a span of 980 ft., one tower acting as a terminal or strain tower for six conductors. Another important river crossing is near Abernethy over the Rivers Tay and Earn. This has a span length of 1,350 ft. and a tower height of 187 ft. But the most spectacular crossing is across the River Forth at Kincardine. Here towers 340 ft. high support conductors having a span length of 3,050 ft. The navigation clearance provided at this point is 158 ft. The ground wire is insulated and capable of use as a conductor in an emergency.

No special precaution to guard against lightning is taken owing to the comparative infrequency of thunderstorms in this territory. There is, how-

Hae Become Minded

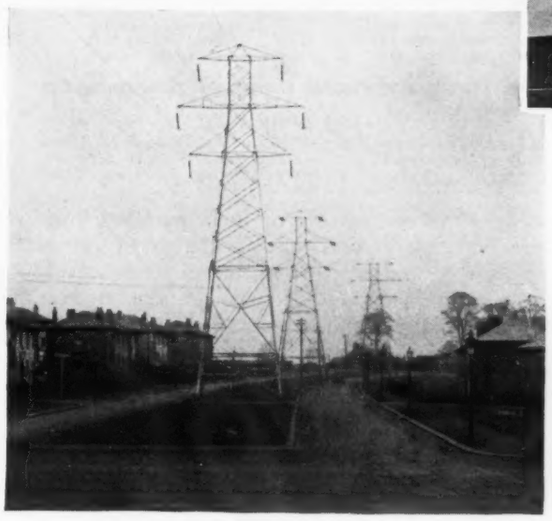
By F. C. WELLS

News Editor "Electrical World"



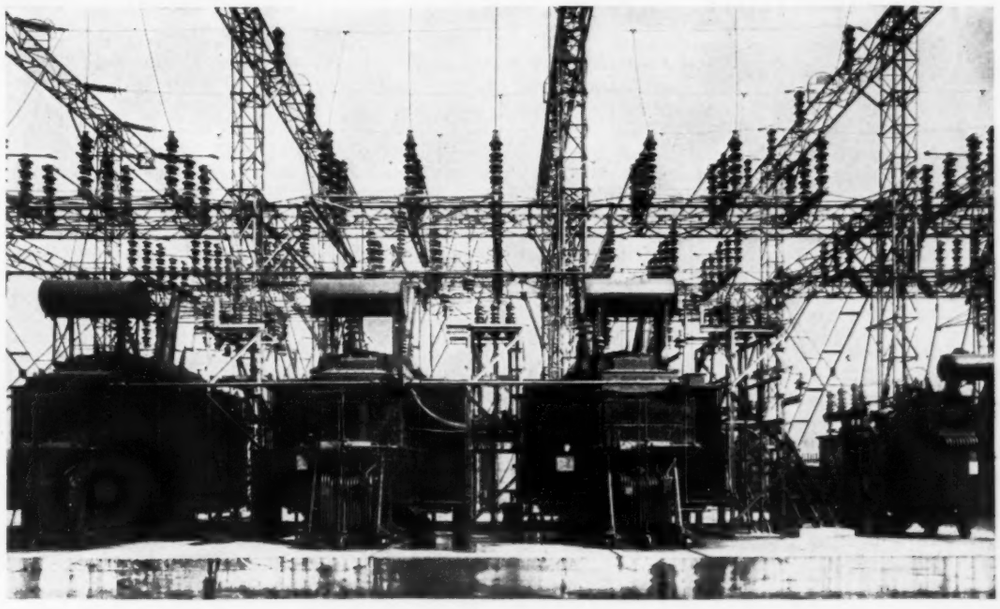
Crossing tower at Renfrew on the Clyde

Double-circuit towers in Dundee



ever, a continuously grounded earth wire, and the neutral point of the 132-kv. winding on every transformer is also earthed.

Necessity for standardization of the frequency in the areas of the two largest concerns — the Glasgow Corporation and the Clyde Valley Electrical Power Company—presents the main obstacle to the immediate complete success of the Central Scotland scheme. These "undertakers" generate 59 per cent of the total output of the grid, and until all the generating and consumers' plants in their territory are converted from 25 cycles to the standard 50-cycle operation no comprehensive scheme of control for the whole area can be put into force. Work is proceeding rapidly, involving an ultimate cost for standardization of about $15,000,000. By March 31 last 37,600 hp. of consumers' motors and 40,500 kw. of rotary-converter plant had been changed over to 50 cycles, and it is aimed to finish the work in 1932.



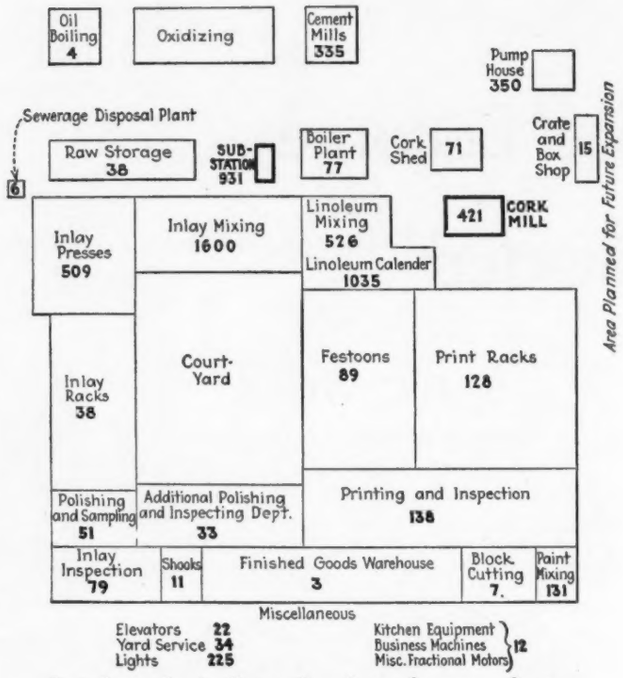
Dalmarnock 60,000-kva. substation

Synchronous Motor Bank Controls Plant Power Factor

IN ORDER to secure the best operating conditions commensurate with the cost of obtaining them, the engineers of the W. & J. Sloane Manufacturing Company, in planning its Trenton, N. J., linoleum factory undertook a careful study of probable load and power factors. As shown in the accompanying figure, the plant, which covers about 14 acres, is laid out with the substation in a strategic position in regard to both present loads and possible plant extensions. Service is received at 26,400 volts from a line of the Public Service Electric & Gas Company and is transformed to 440, 220 and 110 for local use. Two synchronous motor-generator sets, each of 360-kw. rating, are used to provide direct-current energy for print machines and other equipment requiring close speed control on the motors. Most of the electric motors throughout the plant are of the induction type.

The duty requirements of many motors absolutely precluded the possibility of using synchronous machines at some points for power-factor correction additional to that furnished by the motor-generator sets. The heaviest loads are upon the motors driving the mixers and calenders, and these, it may be noted, are very close indeed to the substation, thus minimizing line drop and reducing copper costs. The thirteen substation circuits are arranged so that, so far as possible, a separate circuit serves each important building or process unit, and, in the case of the eight circuits most heavily loaded, watt-hour meter readings on the individual lines indicate the power requirements for a specific step in any mixture of materials that may be used in manufacture.

It was estimated, upon the basis of an approximate connected load of 6,000 hp., that five-eighths of the load would be on at any one time. Corrective equipment to the extent of three-quarters of the connected load was therefore planned. Upon the installation of equipment and the start of manufacturing operations it was found that three-quarters of the load was on at one time and the total now exceeds 7,000 hp.



Load study indicated point of power-factor correction

Load concentrations, duty of motors, character of drives, circuit arrangements and use of power were factors considered in power-factor correction in 7,000-hp. plant.

Upon the assurance of the operating staff that it would be continually satisfactory to them to have the large millstone cork grinders operate at a fixed speed of

Rewiring More Costly than Providing for Future

A few examples may serve to illustrate how high rewiring costs may run and how those costs are lessened by making the original installation adequate or by providing easy rewiring facilities with the original wiring.

A firm of stock brokers desired to install lighting which meant raising the wiring capacity from 2 watts to 7 watts per square foot. As the building where the change was to be made had not yet been completed, the additional wiring could be added for $7,000. The consulting engineer estimates that the same change made after the building was completed and in use would have cost $20,000.

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A department store, fifteen years old, has already found it necessary to rewire large sections three times, each time failing to rewire for the future. Now, the entire main floor and show windows are about to be rewired again at a further high cost, to obtain the modern lighting that it is felt is desirable.

A two-story garage, about 30x125 ft., was rewired in 1926. Desire for more light made it necessary to install a new service and increase the number and size of circuits within three years. This cost 300 per cent more than if the work had been done at the time of the first rewiring.

•

In the plans for a small department store, wiring was laid out for 1½ watts per square foot and 100 watts per 18 in. of show window. After this wiring had been roughed in the owner became convinced that it was inadequate. Additional capacity was installed, giving 3½ watts per square foot and 200 watts per 18 in. of show window. This additional work raised the cost of the wiring installation 30 per cent, and this was $2,500 in excess of what it would have been had the wiring used been called for in the original plans. If it had been necessary to rewire after the building had been completed, to obtain this increased capacity it is estimated that this $2,500 excess cost would have been $12,000 or even more.

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It must be remembered, too, that there are many buildings where the design makes it impossible to rewire at any cost, without destroying the artistic beauties of the building, no matter how great the need for increased service may be. This condition exists solely because in the wiring, now an integral part of the building, a few mills a foot was saved by installing copper that was not capable of taking care of increased requirements.

150 r.p.m., and since virtually all other drives required variable speeds, it was decided to provide these grinders with six 60-hp., 440-volt synchronous motors. Push-button control stations at the motors operate a panel bank in a separate room. Automatic starting with Electric Machinery Manufacturing Company equipment is used. Synchronization is quickly accomplished with a minimum of the line disturbance.

The plant power factor averages between 0.82 and 0.85 and without this bank would be about 0.65, according to J. E. Richford, electrical engineer with W. & J. Sloane. By thus utilizing the two motor-generator sets and a synchronous motor bank close to the center of distribution and where constant speeds could be applied the power-factor problem was largely solved in this plant.

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Industrial Customers Opposed to Government Ownership

"Why we bring FOUR MILLION DOLLARS to Oregon every year"

...by **JOHN W. PARKER**
Vice President and General Manager, Portland Vegetable Oil Mills

HORSE SENSE SERIES...NO 1

"WE could just as well operate our coconut oil mill in any other coast city. Our raw product—copra—comes from the tropics. Our 4 million dollar annual sales are made to soap manufacturers and others all over this country, Canada, and Mexico.

"But we built our plant in Portland for two main reasons. Those same reasons made it possible to merge the plant profitably last year with Durkee Famous Foods Company. We built in Portland and we stay in Portland because this city is a natural gateway to the Orient, source of our raw copra.

"And the other reason is that Oregon power rates are low and they will be still lower as time goes on. A year and a half ago our rates were voluntarily reduced, saving us more than $8,000 on our mill's annual power bill. Our power cost per ton of copra we crush is the lowest of the United States and Philippine Island mills. **Although our mill is entirely electric powered, the cost is but 8% of our total expense and but ½% of our annual business. We're glad to contribute a big industry to Oregon. We want to see Oregon and Portland grow. It will—if Oregon keeps the doors of opportunity open.**

"Because Portland has a better geographical location than many other Northwest cities, it has grown more rapidly. We are fortunate in having cheap power, with rates and profits controlled by the state. And we are fortunate in Oregon, that an industry so large and important to all of us as the privately owned power companies, can do business with a reasonable assurance of profit. The privately owned power companies share our tax burden and develop the country so that they may grow as every Oregon business deserves to grow.

"We would resent any move by the government to 'take over' our factory or build competing plants alongside of us. The power companies have an equal reason for resenting such a move. **If our states or cities could do a better job than the private companies are doing I'd be for municipal ownership. But common sense tells every one of us that politics would creep in—to the damage of Oregon's future growth.** What makes Oregon great is the boundless opportunity to succeed in any honest, well run business. Let's keep it great!"

Jno W Parker

When industrialists, merchants, bankers, farmers, and civic leaders join in advising that municipal ownership can do nothing for the benefit of Oregon and can only serve to eliminate sound private enterprises, it seems to be good horse sense to join in their beliefs. We merely all live from the profits of private enterprises of some sort. Pacific Northwest Public Service Co. ("Peppco").

BOOST FOR OREGON AND EVERYTHING IN IT! IT'S GOOD HORSE SENSE

CONFRONTING an election on November 4 in which a vote will be taken on a state-wide public ownership bill, the two privately owned power companies in Portland, Ore.—the Pacific Northwest Public Service Company and the Northwestern Electric Company—have instituted a newspaper advertising campaign. The theme of all the advertisements of both companies will be "low rates and low taxes." The Pacific Northwest Public Service Company series is called the "Horse-Sense Series." It displays the reasons advanced by prominent industrial leaders why low power rates have contributed to their success and to the development of the state and why they are opposed to federal, state and municipal ownership.

READERS' FORUM

Lines Immune to Lightning Will Ultimately Be Built

To the Editor of the ELECTRICAL WORLD:

I have just read an editorial in the ELECTRICAL WORLD of September 20 entitled "Lightning Interruptions Are Still on the Increase." The data given in this editorial are very interesting but do not indicate anything except that for the last three years lightning storms have been perhaps more frequent or more severe over the Great Lakes division than the previous three years. In the last paragraph of this editorial the following statement is made:

> For the present it appears that more progress is being made in reconnoitering the character and magnitude of Jove's forces than in formulating the tactics that will encompass that atmospheric general's defeat.

Far from this being the truth, the actual facts are that during the last two years tactics have been formulated which it is believed will ultimately enable us to build lines that will be practically immune from lightning. The important results achieved during the last two years are:

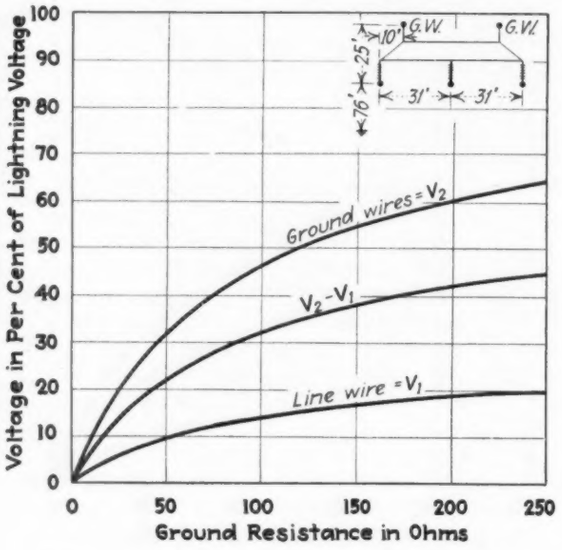
1. Recognition of the fact that on lines above 66 kv. induced surges due to strokes to earth do not have values sufficiently high to be considered troublesome. As a result of this, it is concluded that outages on transmission lines are caused by a direct stroke. The evidence in support of this, which has been given in discussions before the A.I.E.E. and also in articles published in the *Elektrotechnische Zeitschrift* by Dr. Matthias, is quite convincing and an analytical mathematical investigation of the subject also supports these conclusions.

2. If a direct stroke is the cause of transmission line outages, then it is essential that the ground wires be so disposed with respect to the line wires that they will act as shields against the oncoming lightning stroke. Thus the proper configuration of ground wires with respect to line wires is of paramount importance.

3. The spacing between ground wires and line wires should be such that in case of a stroke at midspan to the ground wire, side flash from ground wire to line wire will not take place. In the application of this principle we are confronted by the fact that reliable data as to the potential of a lightning stroke when it strikes the ground wire are not yet available. The present investigations with the co-operation of the power utilities are being carried out to determine the factors which will enable us to obtain the probable values. Based on the supposition that the average lightning stroke produces a current of about 50,000 amp., a value of 10,000,000 volts is indicated. On this supposition, with towers averaging 1,000 ft. apart it would be necessary for the air gap between ground wire and line wire to withstand an impulse of this value for two microseconds, which would require a spacing of approximately 32 ft. Such a spacing is not out of the question for 220-kv. construction and is now being considered for a projected 220-kv. line, but for the lower voltages there is a tendency on the part of the practical transmission engineers to balk at such high spacing on account of the increase in cost of towers resulting therefrom.

Moreover, the claim has been made that lightning

strokes very rarely strike the ground wire at midspan. If this is so, it is an important point, indicating that the usual sag of wires is sufficient to make the towers take the oncoming stroke. My own opinion is that the observations of lightning strokes at midspan have not been carefully made. As a compromise I have recommended that the vertical spacing of ground wires above the nearest line wires should be at least a distance equal to the phase-to-phase spacing of the line wires and as much spacing in the center of the span should be obtained as is possible by decreasing the sag of the ground wires. This construction can be also used very effectively for 220-kv. lines with horizontal configuration, but from the results of past years' lightning investigations I believe



Effect of ground resistance with stroke at tower

Two ground wires. Surge impedance of ground wires = 300 ohms. Mutual surge impedance, ground wires to outside line wire = 91.5 ohms. Coupling factor = 30.4 per cent.

that 32 ft. should be considered a minimum and the center of the span should have a spacing as much above this as it is possible to obtain by increasing the sag of the ground wires.

However, in future construction the suggestion that the vertical height of the ground wire above the line wire should be equal to the phase-to-phase spacing between ground wires does not appear very sound, for the reason that the phase-to-phase spacings in common use at the present time could be materially reduced with a different, and from the point of view of lightning, more effective type of line construction, whereas the configuration of the ground wires with respect to the line wires depends, first of all, upon the lightning potential which requires at the midspan a large spacing, and, secondly, at the tower point sufficient height so that the ground wires will effectively shield the line wires. The determination of the proper height to obtain effective shielding may require some practical experience.

4. This perhaps is the most important element in the design of ground wire protection, namely, the surge impedance to ground of the tower footings must be made as low as possible consistent with economy. The relation between the potential across the insulator string and the surge impedance of towers to earth is shown in the accompanying curve, which was computed for a 220-kv. line which is now under consideration. It will be observed that with a tower surge impedance to ground of 100 ohms the potential across the insulator string will be 32 per cent of the potential of the lightning stroke where it hits the ground wire. This potential will flash over any string of insulators that is contemplated for 220 kv. However, if the tower surge impedance is reduced to 25 ohms the surge potential across the insulator string will only be 13 per cent, and in this case it is possible that the insulator string with sixteen units will prevent flashover if the lightning potential where it strikes the ground wire does not exceed 10,000,000 volts. For tower surge impedance less than this value there is a very rapid decrease; for instance, for 10 ohms the potential is only 7.5 per cent.

It will be obvious that where surge impedance of tower to ground is high, artificial means must be used to reduce it. Such means have been pointed out in the paper by Mr. Conwell and myself and are the result of experiments on actual transmission lines carried out with the surge generator. However, the amount of insulation and the tower footing resistance are dependent upon each other. Where it is impossible to reduce the tower surge impedance to a satisfactory value for a normal length of string, an extra long string with larger tower clearances will be indicated. All these principles have been discussed with the utility engineers and have been referred to in the A.I.E.E. discussions. However, a more complete statement will appear in the *Electric Journal* shortly.

In the case of low-voltage lines ground wires with tower footing surge impedance such as would be normally obtained are not sufficient to reduce the lightning potential to a value which will not flash over standard insulation. For such cases protective devices are being developed which will prevent the lightning flashover from culminating in a dynamic arc, so that even though a lightning flashover takes place an outage will not result. The fused arcing ring is a device which has somewhat of this characteristic, but has the disadvantage that it is expensive to maintain and after the fuse has blown the protection no longer exists for that particular insulator string. Lightning arresters have been installed on a limited number of lines and appear to be giving good results. I understand that this is true also of the fused arcing ring where it has been installed on a few limited lengths of transmission line. In a general survey of transmission lines as they exist, during the past three years very little constructive work has been done so far in applying the above principles for their protection. When more lines have been built according to the principles outlined above the percentage of outages will be reduced. The engineers of some of the more progressive utilities are making use of these principles, and in one outstanding case, namely, 4 miles of experimental line in Wallenpaupack, a further extension of these principles has been made use of. This is the line described in a previous issue of the ELECTRICAL WORLD by Mr. Silver.

Far from the statement in the editorial being true, the generals have formulated their plan of campaign against Jove's forces and confidently expect to bring the campaign to a successful issue.

East Pittsburgh, Pa. **CHARLES L. FORTESCUE.**

Men of the Industry

PHILIP G. GOSSLER, president of the Columbia Gas & Electric Corporation, sailed for Europe October 24 aboard the Cosulich liner *Saturnia*.

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F. R. FISHBACK, president of the Electric Controller & Manufacturing Company, Cleveland, Ohio, has been elected a vice-president of the National Electrical Manufacturers' Association. Mr. Fishback is not a novice in this office, having served as vice-president of the association for the year 1928-1929 in charge of the apparatus division.

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ROGER DEWOLF, formerly assistant superintendent of the Rochester Gas & Electric Corporation, has been named superintendent of steam power distribution at Reading, Pa., by the Associated Gas & Electric Company. Mr. DeWolf removed to Rochester several years ago from the South and has been assistant to Thomas W. Yawger, superintendent of the electrical division of the Rochester utility. E. R. CROFTS, formerly purchasing agent of the Rochester company, will succeed Mr. DeWolf.

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SIR JAMES LITHGOW, who was one of the original members of the Central Electricity Board of Great Britain, appointed in 1927, has resigned from the board in view of the pressure of his other duties, and the Minister of Transport has appointed in his place SIR RALPH LEWIS WEDGWOOD, chief general manager of the London & North Eastern Railway. The Central Electricity Board was constituted under the provisions of the electricity (supply) act, 1926, and consists of a chairman and seven other members appointed by the Minister of Transport.

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G. ROSS HENNINGER, for the past six years engineering editor of *Electrical West*, with headquarters in San Francisco, has resigned to become associate editor of the *Journal* of the American Institute of Electrical Engineers, with headquarters in New York City. Mr. Henninger joined the McGraw-Hill Company of California after severing his connection with the Southern California Edison Company, where he was serving as operating assistant to the electrical protection engineer. He was formerly connected with the Westinghouse Electric & Manufacturing Company. At Institute headquarters in New York Mr. Henninger will be in responsible charge of the organization and operation of the extensive changes in publication policy that were officially adopted at the summer convention of the Institute held in Toronto in June, 1930.

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J. E. Loiseau Heads Rocky Mountain Division

J. E. LOISEAU, who was elected president of the Rocky Mountain Division of the National Electric Light Association, as announced in the October 25 issue of

the ELECTRICAL WORLD, has been secretary of the Public Service Company of Colorado since 1922. During this connection with the public utility industry, Mr. Loiseau has been an active figure in electrical circles in the mountain region.

A native of South Dakota, Mr. Loiseau obtained his early commercial experience with the Missouri Pacific Railway and with the Mount Vernon Car Manufacturing Company in Illinois. It was in 1915 that he entered the employ of the local power company at Mount Vernon, later being transferred to Mansfield, Ohio. There he served as secretary and treasurer of the Richland Public Service Company and the Ashland Gas & Electric Light Company. In 1920 he was elected secretary of the Montgomery (Ala.) Light & Water Power Company and served in that capacity until the property was sold and he was transferred to his present position in Denver.

In addition to being prominent in the affairs of the Rocky Mountain Division of the National Electric Light Association since transferring his interests to Denver, Mr. Loiseau has also been active in the Accounting National Section. He has also been chairman of the Rocky Mountain Commission on Public Utility Information, a member of the Denver Chamber of Commerce and other civic associations.

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EDWARD HOPKINSON, JR., of Drexel & Company, has been elected a director of the Public Service Corporation of New Jersey to succeed Thomas S. Gates, who resigned to become president of the University of Pennsylvania. Mr. Hopkinson was also elected a director of the various underlying companies of Public Service, of which Mr. Gates was previously a director.

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HARRY W. BARNARD, president of the Rome Wire Division of the General Cable Corporation, has been elected treasurer of the General Cable Corporation. Mr. Barnard will retain his office in Rome. He succeeds William C. Hall, who resigned his duties as treasurer, continuing as secretary with headquarters in New York. Mr. Barnard, who is also general manager of the Rome Wire branch, has been associated with this company for many years.

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R. S. APPERSON, chief dispatcher of the Texas Power & Light Company, has in addition assumed the duties of superintendent of transmission. Mr. Apperson started about fifteen years ago with the Phoenix Construction Company. He will be in charge of both operation and maintenance of the transmission system.

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R. J. COBBAN, since 1924 in charge of the central station division of the Westinghouse Electric & Manufacturing Company in Portland, Ore., has been appointed central station division supervisor of the company's San Francisco office. He succeeds W. P. L'Hommedieu, who recently was made manager of that office. Mr. Cobban entered the Westinghouse organization as an apprentice at East Pittsburgh in 1909

after graduation from the University of Minnesota as an electrical engineer. During twenty years of his sales work in Butte, Seattle and Portland he has been active in the application of electric power to metal mining operations, lumbering and the paper industry. During more recent years he has been spending a large portion of his time on the problems of generation and distribution of electric power. C. C. BOOZIER, since 1927 central station group leader in the Westinghouse San Francisco office, has been transferred to Portland to take up Mr. Cobban's duties.

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GEORGE D. WOODS, formerly secretary and treasurer of the Public Utility Holding Corporation, has been elected vice-president and treasurer and GEORGE RAMSAY has been elected secretary.

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R. H. PARK, formerly connected with the central-station division of the General Electric Company at Schenectady, has joined the engineering department and has been assigned to the electrical division.

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MARSHALL G. HOUGHTON, for the past 3½ years electrical engineer with Allied Engineers, Inc., Jackson, Mich., has been appointed supervisor of electrical engineering at the Detroit Institute of Technology.

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A. L. O'BANION has resigned as professor of electrical engineering at Clemson Agricultural College, South Carolina, to join the design division of the Stone & Webster Engineering Corporation, Boston.

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M. F. LUCIEN J. JUMAU of the Compagnie Générale d'Electricité of Paris, one of the leading French authorities on accumulators, has recently been appointed a chevalier of the French Legion of Honor.

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GEORGE A. OPP, safety engineer with the Detroit Edison Company, and H. F. WEBB, who is connected with the West Penn Electric Company, have been elected counselors of the public utilities section of the National Safety Council.

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NORMAN G. HARDY, production engineer for the Texas Power & Light Company for the past seven years, has been appointed superintendent of power to succeed E. T. Keck, now manager of engineering and power. Mr. Hardy's early experience was obtained as power plant engineer with the Cananea Consolidated Copper Company, Cananea, Mexico, and with the Arizona Copper Company at Clifton as superintendent of power in charge of power plants, transmission lines, air compressor and mine hoist stations. In 1922 he became chief engineer of the Waco plant of the Texas Power & Light Company and one year later removed to the company's general offices as production engineer.

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FRANK A. KETCHAM, president of the Graybar Electric Company, has been elected a director of the Marine Midland Trust Company.

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G. A. DOELLER, who is connected with the Dayton Power & Light Company, Dayton, Ohio, has been elected vice-chairman in charge of electrical interests of the public utilities section of the National Safety Council.

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THOMAS B. RICHARDSON has entered the engineering department of the Hartford Steam Boiler Inspection and Insurance Company at Hartford, Conn., as chief engineer of the turbine and engine division. A graduate of Alabama Polytechnic Institute, Mr. Richardson has given special attention to the steam turbine and is familiar with developments in that field during the past twenty years. For the past two years he has been associated with the management of a utility plant in Florida.

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C. E. STRICKLIN, since 1912 employed in the state engineering office, Salem, Ore., has been appointed state engineer by Governor Norblad to succeed Rhea Luper, resigned.

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JAMES B. MACLEAN, who has been connected with the J. G. White Engineering Corporation as an engineer in the electrical division, has been transferred to the electrical department of the Central Railroad Company of New Jersey to be assistant engineer.

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R. E. FISHER, vice-president of the Pacific Gas & Electric Company, San Francisco, in charge of public relations and sales, has been elected a member of the board of directors of the Aviation Corporation of America, New York City. Mr. Fisher has taken a prominent part in activities in behalf of aviation development in California and for several years has been chairman of the aviation committee of the California Chamber of Commerce.

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OBITUARY

WILLIAM E. DAVIS, consulting engineer of Cleveland, died October 9 in that city. He took a leading part in building street-railway lines in Toronto, Canada, and the Lake Shore Electric Railway in Ohio. At one time he was light and heat commissioner of Cleveland. He was also consulting engineer in construction of the Cleveland Union Terminal.

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JOSEPH M. BURKET, who was connected with the National Electrical Supply Company, died at his home in Washington, D. C., October 13. Mr. Burket was a native of Gettysburg, Pa., and removed to Washington in his boyhood. During the first stages of a city-wide system of electricity in that city he was associated with the late George C. Maynard, and later he became associated with the Fire Underwriters' Association as an inspector. He was 74 years of age.

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EDWARD P. ROBERTS, consulting engineer of Cleveland, died October 19 in his seventy-fourth year. He was a member of the engineering firm of Roberts & Abbott. Mr. Roberts was born in New York City and was graduated from the Stevens Institute of Technology. For a time he was an associate professor of electrical engineering at Cornell University and later was manager of the Swan Lamp Company of Cleveland. Mr. Roberts was president of the Cleveland Engineering Society from 1911 to 1913.

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FELIX E. SHWAB, formerly connected with the electric supply business and the telephone business in Nashville, Tenn., died at his home in that city October 16. Mr. Shwab was a native of Nashville and attended Harvard University. Seven years ago he was vice-president of the Tennessee Electrical Company, Nashville, a wholesale organization in the electric appliance field.

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J. HAL LIVSEY, manager for the General Electric Company in Detroit and the lower peninsula of Michigan, died suddenly October 4 at the Drake Hotel in Chicago, while on a business trip. Since 1894 Mr. Livsey had been a resident of Detroit, having the same business connection throughout the 36 years. He was born November 21, 1864, in Pittsburgh, Pa., and after completing his college education in Pennsylvania he entered the electric light and power industry, which was then in its infancy. He left the Edison Electric Illuminating Company of New York in 1890 to affiliate himself with one of the several companies which in 1892 were merged to form the present General Electric Company.

Financial and Statistical News

THE $600,000,000 decline in brokers' loans during the past month in the face of a larger volume of trading is interpreted as reflecting buying by strong interests. Further evidence is the obvious increase in selectiveness.

——THE SHORT INTEREST IN THE MARKET is said to be still substantial, but it is becoming much more inconvenient to borrow stock. Resultant weakening of this short interest has been an aid recently to the advance movement.

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Public Service of Northern Illinois to Issue Rights

AT A MEETING of the board of directors of the Public Service Company of Northern Illinois held October 14 it was voted to apply to the Illinois Commerce Commission for authority to issue additional no-par common stock to the extent of 16⅔ per cent of the company's outstanding stock of all classes. If the issue is authorized by the commission the stock will be offered at $100 per share to the stockholders of record December 15, 1930, first payment to be made on or before February 2, 1931. Stockholders will have the privilege of making payment in full or in quarterly or ten monthly payments.

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Swiss Water Can Yield More Power

ACCORDING TO A REPORT recently issued by the Swiss Water Utilization Department there were approximately 6,000 small and large hydro-electric power stations, totaling 2,235,000 hp., in operation in Switzerland at the beginning of the present year, at which time six additional stations, aggregating a further 428,000 hp., were in course of construction. When these are completed it is estimated that there will still be water power to the extent of nearly 1,400,000 hp. available for utilization.

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Continental Shares Adds to Holdings in United Light

ACCORDING TO RECENT DISPATCHES from the Middle West, Continental Shares, Inc., has added to its holdings 394,987 shares of class B common stock of the United Light & Power Company. This acquisition increases the holdings of the Continental Shares in the United company to 416,212 shares, or approximately 40 per cent of the voting stock. United Light & Power controls subsidiaries serving 800 communities with an aggregate population of more than 5,750,000 in Iowa, Tennessee, Indiana, Illinois, Michigan, Wisconsin, Texas, Ohio, Nebraska, Missouri and other states. Two years ago, when it obtained control of the American Light & Traction Company, the Otis-Eaton interests became dominant in the properties. Prior to that time control was shared by them with the Koppers-Mellon group. The Koppers-Mellon interests still have an important investment in the company, as have the American Commonwealths Power, American Superpower and other utility holding companies. As Continental Shares, Inc., is controlled by the Otis-Eaton interests, its acquisition of a controlling interest in United Light & Power in effect maintains this property in the hands of its present operators.

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Factors to Be Considered in Buying Utility Bonds*

By AUSTIN McLANAHAN

President Savings Bank Division, American Bankers' Association

IN THE purchase of public utility bonds it is important to know whether the franchises extend beyond the life of the bonds to such a period as to make the refinancing of the bonds practicable at maturity. An investor in public utility bonds should acquaint himself with the various kinds of franchises which are granted. This is becoming increasingly difficult due to the size of the operating companies which now issue bonds covering properties and franchises in considerable number of communities. The traction situation in Chicago is a good illustration of what may happen to bonds maturing at the same time as a franchise, though secured by property valued greatly in excess of the amount of the bond issue, and earning by a wide margin throughout their entire life the interest upon the bonds.

The complexity of the financial structure of many of the public utilities also makes difficult a clear comprehension of the security of the bond. Efforts are being made by some of the companies to reduce this complexity and render the situation more clear.

It is desirable to buy closed mortgage bonds on public utility companies operating under satisfactory franchises in large and growing communities, but such bonds are becoming more scarce each day. Many such issues are being called and replaced by refunding or "open-end" mortgages.

This represents another phase of public utility bonds. The companies argue that the growth of their business is so rapid and the necessity for supplying new capital so great that it is impracticable to issue a limited amount of bonds, that ample security is afforded, and their needs best served, by what is called an "open-end" mortgage, permitting an unlimited amount of bonds to be issued under restrictions as to the percentage of bonds to be certified, based upon cost of new property, usually about 80 per cent of the cost, and also that the earnings of the company for a period preceding the new issue, usually twelve to fifteen months, shall be, say, 1¾ to two times the interest on the bonds outstanding together with the new bonds to be issued.

Market condition important

Leaving aside for the moment the desirability from the standpoint of the bond buyer of purchasing a security which has no chance of improving its status by enjoying any unearned increment, as does a closed mortgage bond usually, and the security of which may, on the contrary, be diluted by additional issues of bonds, the question arises as to the market situation which may develop for such bonds. If the first issue be moderate in amount and take place in a high bond market at a time when

**From an address before American Bankers' Association convention.*

the company can make a very strong statement of property and earnings the bonds may bear interest at 4½ per cent and sell to the public around 97½. Subsequently, the company may acquire additional property and to pay for it sell in a tight money market 5 per cent bonds at 95. As both series of bonds are secured by the same mortgage, the 4½ per cent bonds at once sell down to approximately the same basis as the 5s with a heavy book loss to the original investor and at the end of the year he writes off his bonds to the new basis. It would seem that, however well secured the bonds may be, the investor can only feel comfortable about the book value of his open end mortgage bonds if they are purchased in a low bond market. Furthermore, the issuance of additional bonds is usually not based upon an equal contribution to capital by the junior security holders and especially by the holders of the common stock, but only upon cost of new property and ratio of bond interest to earnings available therefor.

While the growth and stability of earnings up to the present time has been noteworthy a prudent investor may well consider the possibility that no tree grows to the sky and that the dependence upon the undisturbed continuance of the monopoly through the franchise and upon the necessity of generation and distribution from a central power plant may have elements of weakness as yet undisclosed.

Attention is not called to these phases of public utility financing through a desire to be critical or to minimize the contribution the companies have made to the prosperity of the country, but from a belief that they have not been given the consideration by investors to which they are entitled. There are, of course, a great many public utility bonds suitable for the investment of savings funds, bonds which enjoy the highest rating, and are comparable to the best railroad bonds. It is recommended that the investor familarize himself with the laws of New York and Massachusetts regarding the investment of funds in public utility bonds and study the bond issues which have been made legal in those states. These laws were placed on the statute books only after a very careful study of public utility securities had been made. The purpose of these remarks is to emphasize the fact that this type of bond is much younger than railroad bonds and the industry has not had to endure any setbacks of moment in recent years.

It follows that the purchase of bonds of holding companies which obtain their revenues from dividends on stocks of operating companies which themselves have bonds outstanding involves, in the great majority of cases, a risk to which savings funds should not be exposed.

Holding Companies Behind Utilities' Rapid Growth*

By MARTIN J. INSULL
President Middle West Utilities Company

THERE is no connection between the rate of return and the market price for utility securities except so far as any change in the rate of return would affect the earnings of the utilities and therefore the value of their securities. Prices for utility securities are based upon the earnings of the company, the reputation of its management and the ruling price for securities of similar risk.

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The feeling that the holding company adversely affects rates for electric service can only be attributed to a lack of understanding of the financial structure of the operating companies and the holding companies that control them. If one adds the total issue of the securities of an operating company to that of the holding company that controls it, one would arrive at a figure much larger than the aggregate securities of the two in the hands of the public. From this it might be assumed that rates for service would have to be such as to earn a return upon the total issue of securities of both corporations. However, by eliminating the amount of securities of the operating company in the treasury of the holding company it will probably be found in many cases that the aggregate amount of securities of both corporations in the hands of the public is less than the total securities issued by the operating company alone. This being so, the rates would only have to be enough to earn a return upon an amount of securities equal to or less than those issued by the operating company to which the rates are paid.

As a matter of fact, we know that rates are not based on securities issued, but on the fair values of the property used and useful in the public service.

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Of the eleven billion dollars invested in the electric light and power industry, nine billions has been provided in the last twenty years—the period in which the investment companies have been developed. At least two billions of this money is represented by common stocks of operating companies, which largely rest in the treasuries of their respective investment or holding companies. The assets of these companies are principally securities of the operating companies they control, of which the preponderance is in common stocks. Thus, as heretofore explained, they assume the major risk in any one of their operating companies.

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Charges of holding companies to their subsidiaries for expert services have been the subject of criticism where they are made on the basis of a percentage of gross income and of total construction. If these charges have been above the market cost of such services, the criticism is justified. However, whether these charges are made on a percentage basis or on a time basis for specific services rendered, they are subject to the revision of the regulating commissions in the course of their supervision of capital and operating expenditures of the operating companies. Such charges should certainly not be greater than would be the market price for similar services rendered by outside expert firms that could render a service equal to that rendered by holding companies to their subsidiaries. It must be acknowledged, however, that the experts of the holding companies, constantly dealing with utility problems and having utility experience covering wide fields, have a better knowledge of the subject than independent experts.

**From an address before Illinois Committee on Public Utility Information, Decatur, Ill.*

CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
Alabama Power & Subs (Year ended August 31)					
Gross earnings	$18,035,251	$18,111,158	—0.4	42	37
Net earnings	10,392,330	11,373,724	—8.7	..	..
American Commonwealths Power & Affil. Cos. (Year ended August 31)					
Gross revenues	27,570,124	20,953,603	31.6	57	54
Net income	12,801,247	8,954,052	43.0	..	..
California Oregon Power (Year ended July 31)					
Gross earnings	3,731,258	3,465,165	7.7	..	..
Net earnings	2,206,195	2,195,440	0.4	..	..
Commonwealth & Southern & Subs. (Year ended August 31)					
Gross earnings	145,062,098	145,464,771	—0.2	49	49
Net earnings	73,814,479	74,416,922	—0.8	..	..
Consolidated Gas, Electric Light & Power of Baltimore (Year ended August 31)					
Gross earnings	28,429,429	27,397,575	3.7	66	66
Net earnings	9,600,296	9,439,858	1.7	..	..
Consumers Power (Year ended August 31)					
Gross earnings	32,987,424	32,964,592	0.0	47	49
Net earnings	17,538,222	16,742,047	4.8	..	..
Dallas Power & Light (Year ended July 31)					
Gross earnings	5,234,820	5,046,904	4.0	47	46
Net earnings	2,777,748	2,747,167	1.0	..	..
Eastern Utilities Associates (Year ended August 31)					
Gross earnings	9,330,184	9,095,728	2.6	..	..
Net earnings	3,783,541	3,577,259	5.8	..	..
Eastern Texas Electric & & Constituent Cos. (Year ended August 31)					
Gross earnings	10,208,449	9,319,906	9.5	..	..
Net earnings	4,245,743	3,892,988	9.1	..	..
El Paso Electric & Constituent Cos. (Year ended August 31)					
Gross earnings	3,648,987	3,402,130	7.2	..	..
Net earnings	1,603,043	1,419,125	13.0	..	..
Engineers Public Service & Constituent Cos. (Year ended August 31)					
Gross earnings	52,677,808	45,607,286	15.7	57	58
Net earnings	22,687,263	19,354,344	17.2	..	..
Galveston-Houston Electric & Subs. (Year ended August 31)					
Gross earnings	4,927,679	5,270,023	—6.5	..	..
Net earnings	1,524,955	1,720,860	—11.4	..	..
Georgia Power & Subs. (Year ended August 31)					
Gross earnings	23,770,082	24,058,599	—1.2	49	47
Net earnings	12,139,601	12,779,836	—5.0	..	..
Kansas City Power & Light (Year ended August 31)					
Gross earnings	14,669,899	14,380,174	2.1	49	51
Net earnings	7,454,967	7,079,880	5.3	..	..
Louisville Gas & Electric (Year ended July 31)					
Gross earnings	10,444,559	10,036,018	4.1	..	..
Net earnings	5,389,573	5,165,767	4.3	..	..
Mountain States Power (Year ended July 31)					
Gross earnings	3,470,863	3,252,249	6.7	..	..
Net earnings	1,315,471	1,280,396	2.7	..	..
Nevada-California Electric & Subs. (Year ended August 31)					
Gross earnings	5,620,664	5,595,388	4.5	49	47
Net earnings	2,861,065	2,956,665	—3.2	..	..
Northern States Power (Year ended July 31)					
Gross earnings	33,128,246	32,231,769	2.8	..	..
Net earnings	16,571,060	16,682,695	—0.6	..	..
Oklahoma Gas & Electric (Year ended July 31)					
Gross earnings	14,751,795	13,377,933	10.3	..	..
Net earnings	6,902,823	6,424,603	7.5	..	..
Philadelphia Company (Year ended July 31)					
Gross earnings	63,019,878	62,730,636	0.4	..	..
Net earnings	30,846,925	30,325,299	1.7	..	..
Puget Sound Power & Light & Subs. (Year ended August 31)					
Gross earnings	17,108,677	15,941,016	7.3	..	..
Net earnings	7,277,003	6,693,510	8.7	..	..
San Diego Consolidated Gas & Electric (Year ended July 31)					
Gross earnings	7,248,876	7,283,397	—0.4	..	..
Net earnings	3,494,094	3,379,363	0.4	..	..
Savannah Electric & Power (Year ended August 31)					
Gross earnings	2,217,330	2,203,153	0.6	..	..
Net earnings	1,035,905	996,627	3.9	..	..
Southern California Edison (Year ended August 31)					
Gross earnings	41,087,913	38,386,490	7.0	33	33
Net earnings	27,427,528	25,399,677	8.0	..	..
Southern Colorado Power (Year ended July 31)					
Gross earnings	2,295,168	2,271,933	1.0	..	..
Net earnings	1,064,268	1,096,209	—2.9	..	..
Standard Gas & Electric & Subs (Year ended July 31)					
Gross earnings	155,044,452	151,235,532	0.2	..	..
Net earnings	74,406,008	72,255,247	3.0	..	..
Tampa Electric & Subs. (Year ended August 31)					
Gross earnings	4,583,008	4,591,269	—0.2	..	..
Net earnings	1,530,825	1,485,727	3.0	..	..
Tennessee Electric Power & Subs. (Year ended August 31)					
Gross earnings	15,268,991	14,158,108	7.8	52	52
Net earnings	7,865,327	7,227,557	8.8	..	..
Virginia Electric & Power & Subs. (Year ended August 31)					
Gross earnings	17,184,073	16,835,920	2.1	..	..
Net earnings	7,730,146	7,500,951	3.1	..	..
Wisconsin Public Service (Year ended July 31)					
Gross earnings	5,603,812	5,286,778	6.0	..	..
Net earnings	2,415,146	2,300,940	5.0	..	..

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October Issues Total $51,819,600

DURING THE MONTH OF October offerings of new securities by the electric light and power companies of the country amounted to $51,819,600, as compared with $156,829,000 in the month of September and $31,725,000 in October, 1929. October brought the ten-month period to a close with a total amounting to $1,176,011,534, as against $798,860,000 for the similar period of the preceding year, which is an increase of 47.1 per cent.

The average yield on these flotations continued on the downward grade to 4.55 per cent, as compared with 5.09 per cent in the preceding month and 5.40 per cent in August.

It is interesting to note that three Canadian loans were floated during the month of October.

New Security Issues of Electric Service Companies in October

Name of Company	Amount	Period (Years)	Class	Purpose	Interest Rate	Price	Per Cent Yield
Engineers Public Service Co.	$7,500,000	..	Cumulative preferred stock	To finance cost of additions to property of constituent companies through additional investment in the equity of these companies and for other corporate purposes	6	100	6
American States Public Service Co.	819,600	18	First lien gold bonds, series A	To retire outstanding securities of subsidiary companies and for the funding of obligations incurred by the company in the acquisition of new properties and through additions to and improvements of physical properties	5½	89½	6.50
Super-Power Company of Illinois	10,000,000	40	First mortgage gold bonds	To pay for cost of additional generating capacity	4½	96	4.72
New Jersey Power & Light Co.	2,000,000	30	First mortgage gold bonds	To retire bonds	4½	101½	4.40
Edison Electric Illuminating Co. of Boston	20,000,000	2	Notes	To retire maturing notes	4	99.62	4.20
	10,000,000	1	Notes	To retire maturing notes	3¾	99.87	3.87
Texas-Louisiana Power Co.	1,500,000	30	First mortgage gold bonds, series B		5½	94	5.94
Total	$51,819,600			Rights	$14,250,000		
Total amount actually realized	$51,184,542			Total financing for October	$65,434,542		

Business News and Markets

Heavier and Larger Units at National Power Show

HEAVIER AND LARGER UNITS, many of them in actual operation, will be shown at the National Exposition of Power and Mechanical Engineering to be held at Grand Central Palace, New York, December 1 to 6. Two years' efforts will be put into one as there will be no power show next year.

Manufacturers anticipate increased buying interest this year in view of the low buying volume during past months. One nationally known manufacturer has arranged to show one of the largest units that go into the operation of a power plant, so far as fuel-burning equipment is concerned, under practical operating conditions.

The keen rivalry of the past few years between the manufacturers of pulverized-fuel equipment and those who manufacture automatic stokers is reflected in the show in that both classes of equipment are represented in a greater and more interesting variety than ever before. The two schools of practice will certainly have an excellent opportunity to compare the mechanical equipment that is now offered, and those who felt some years back that the automatic stoker had reached the zenith of its development will be interested to note the refinements that the demands of modern power production have brought about in the new types of automatic stokers.

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New Lighting Code for Factories and Mills

A REVISED AMERICAN STANDARD, "Code for Lighting Factories, Mills, and Other Workplaces" (All-1930), has just been approved by the American Standards Association following its approval by the Illuminating Engineering Society, which took a leading part in the development of the code. The code, which applies to practically all industries, is intended as a guide for factory owners and operators in their efforts to improve lighting conditions in their factories and also as a source of authoritative information for those preparing safety regulations. It contains sections on measurement of illumination, recommended levels of illumination, avoidance of glare, specifications of adequate wiring, locating switches, and a suggested minimum regulation to be established by state authorities.

Good lighting plays an outstanding rôle in industrial economy, the introduction to the code states, some of its results being reduction of accidents, greater accuracy in workmanship and the resulting improved quality of goods, increased production, greater contentment of workers, greater cleanliness, more order and neatness in the plant, and easier supervision of employees.

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New York Metal Prices

	Oct. 22, 1930 Cents per Pound	Oct. 29, 1930 Cents per Pound
Copper, electrolytic	9¼–10	9¼
Lead, Am. S. & R. price	5.10	5.10
Antimony	7⅛	7⅛
Nickel, ingot	35	35
Zinc, spots	4.30	4.35
Tin, straits	27.37	27
Aluminum, 99 per cent.	23.30	23.30

Voltages and Frequencies Are Diverse in Europe

WHAT KIND OF ELECTRIC SUPPLY do they have in—(the name is that of some foreign city anywhere on the face of the globe)? The question comes up with surprising frequency, asked perhaps by a traveler who wants to take along an electrical appliance, perhaps by a manufacturer interested in the overseas market.

The Department of Commerce is gradually finding the answers. Circular 591, revised, issued by the Electrical Equipment Division and comprising sixteen pages, gives a list of electric current characteristics for the principal cities in every European country from Albania to Yugoslavia.

The prospective shipper will do well to inform himself on the diversity of voltages and frequencies here represented; in some instances several occur side by side in the same city.

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Opportunities and Pitfalls in Electrical Export Trade

WHERE are the most promising foreign markets for American electrical goods? What new markets can be developed? Who are the buyers in these various countries? These are some of the questions manufacturers ask at a time when domestic business is suffering from the effects of a major depression.

Such problems merit careful study. Although it is true that business abroad is also suffering, it is reasonably certain that recovery from the depression will be accompanied by an intensifying of the struggle for world markets. While more rigidly protecting their home markets, the leading nations are entering upon a gigantic effort to capture a larger portion of trade abroad. This means more intensive effort will be needed to maintain even the *status quo*. At the same time the opportunities promise to be well worth fighting for. Europe in particular is armed with the low-price weapon. America's fort is in quality and mass production. The degree of systematic and sustained cultivation of these foreign markets exerted is the factor which will tip the scales.

The leading exporters of electrical lines at present are the General Electric Company, the Westinghouse Electric & Manufacturing Company and the International General Electric. In addition, however, are combination export managers who sell for cash or on credit of the buyer abroad, accepted by the manufacturer.

The ten leading markets for American electrical equipment and appliances last year aligned themselves thus:

Canada	$44,203,227
United Kingdom	9,771,306
Argentina	9,027,055
Australia	7,969,102
Brazil	7,708,994
Mexico	7,606,577
Cuba	4,852,085
Japan	4,741,913
Chile	3,383,086
China	3,138,063

While Canada is the largest buyer, the Dominion is regarded more in the category of a domestic than a foreign

market. Recently increased tariffs affect electrical goods in certain lines, but the threatened effect of these changes is probably exaggerated. The second largest buyer in 1929 was the United Kingdom, and in certain types of equipment that country offers a ready market.

But it is probably in some of the newer countries that the greatest expansion in trade will be achieved. Some of the South American republics, notably Argentina and Brazil, are wide open to our products. Argentina's principal purchases from us last year were batteries, distribution transformers, motors, fans, radio equipment, outlet and switch boxes. Brazil's totals show a wide range, including transformers, switches, circuit breakers, meters, motors, locomotives, telephone equipment, wire and cable, and, of course, refrigerators.

Large market nearer home

Nearer home there is another huge potential market. As one travels through Mexico he finds that that country depends on us for most of her imported electrical goods. Mexico's demands for modern electrical equipment and devices are growing more rapidly than might be assumed. Mexico's purchases last year lined up about as follows: Generators, switches, stationary motors and parts, radio sets, wire and cable.

Although part of the British Commonwealth, Australia finds certain classes of our goods more suitable for her use than those purchased in Great Britain. Her needs in the order of their importance include motors and accessories, radio sets and parts, vacuum cleaners and washers, lighting sockets, switches and refrigerators.

One of the surprises of the export market is Soviet Russia's trade. During June the Union of Socialist Soviet Republics stood third in the world list of electrical importers from the United States, and in July it stood fifth.

In many of these countries the opportunities are large. But the competition is keen and there are many pitfalls. For the manufacturer not familiar with these it is advisable to proceed cautiously. Helpful—in fact, essential—information is gladly provided by the Bureau of Foreign and Domestic Commerce, Washington. Furthermore, the export unit of the McGraw-Hill Publishing Company has been active in furnishing advice gratis on exporting to Latin America, particularly since its acquisition a little over a year ago of *Electricidad en America*, a merchandising magazine published in Spanish.

To those trading abroad for the first time it is essential to lay out a definite plan of attack covering three years or more. Abortive attempts upon the foreign market are often costly and discouraging.

What some of the opportunities and some of the pitfalls are will be discussed in these colmns in coming issues.

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Arc-Welding Competition

To designers and engineers in every industry where iron and steel forms all or part of the manufactured product is again given the opportunity by the Lincoln Electric Company, Cleveland, to show their skill and ingenuity in utilizing the advantages of arc-welded construction. As a reward for their efforts $17,500 will be awarded for the 41 best papers submitted in the competition. The jury of awards will be composed of the electrical engineering department of Ohio State University.

The purpose of this competition is to stimulate designers and engineers in every line of industry to think of the manufacture of their own products by the use of arc welding and to increase their knowledge of the feasibility of its application. This is the second prize competition launched by the company.

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TRADE BRIEFS

General Kontrolar Company, manufacturer of railway signals, electrical control devices and mercury switches, with offices in Dayton, Ohio, has named Leon J. Mower vice-president and sales director. He was formerly in charge of the Western sales organization of the company.

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Johns-Manville Corporation and subsidiaries for the three months ended September 30 report net profit, after depreciation, depletion, federal taxes and other charges, of $1,202,867, equal after preferred dividends to $1.43 a share on the common stock, as compared with $998,529 or $1.16 a share in the preceding quarter and $2,483,300 or $3.14 a share in the third quarter of the previous year. Net profit for nine months ended September 30 amounted to $2,943,027 after above deductions, equal to $3.40 a share, as against $5,552,396, or $6.84 a share, for the similar period of 1929.

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Cutler-Hammer, Inc., announces the appointment of B. L. Donahue to the position of manager of the Buffalo district.

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The Line Material Company of South Milwaukee, Wis., is building a Southern plant at Birmingham, Ala. Among products to be manufactured in the Southern factory are street-lighting equipment both ornamental and overhead; fuses, switches, fiber conduits, brackets and racks of all descriptions, steel pins for insulation and pole-line hardware.

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Allis-Chalmers Bookings Down 4.4 per Cent

Allis - Chalmers Manufacturing Company's report for nine months of 1930 shows net profit of $3,034,522, equivalent to $2.41 per share on the 1,258,400 shares of no-par common stock outstanding. This compares with $3,379,340 for the corresponding nine months of 1929, or $2.68 on similar per share basis. For the September quarter the net was $682,982, compared with $1,200,252 for like period a year ago.

Bookings for the current nine months amounted to $36,348,300, contrasted with $38,002,545 in the 1929 period, a drop of less than 4½ per cent. Unfilled orders September 30 aggregated $15,545,566, as against $12,872,676 at the close of 1929, an increase of 21 per cent. On September 30 last year unfilled orders were $13,390,832.

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DELINQUENT ELECTRICAL ACCOUNTS

(National Electrical Credit Association)

Number of Accounts Reported

Division	September 1929	September 1930	Per Cent Increase or Decrease	Nine Months 1929	Nine Months 1930	Per Cen Increase or Decrease
New York	224	192	—14.3	2,319	2,614	+12.7
Middle and Southern Atlantic States	184	126	—31.5	1,489	1,459	—2.00
New England	91	92	+1.1	1,224	1,082	—11.6
Central	618	529	—14.4	5,654	6,560	+16.0
Total	1,117	939	—15.9	10,586	11,715	+9.6

Total Amounts Reported

Division	September 1929	September 1930	Per Cent Increase or Decrease	Nine Months 1929	Nine Months 1930	Per Cent Increase or Decrease
New York	$36,063	$16,722	—53.6	$444,366	$420,611	—5.3
Middle and Southern Atlantic States	14,069	11,232	—20.2	201,861	225,516	+11.7
New England	11,335	6,217	—45.1	171,455	144,901	—15.4
Central	66,592	59,727	—10.3	681,216	856,922	+25.8
Total	$128,059	$93,898	—26.7	$1,498,898	$1,647,950	+ 9.9

Market Conditions

PROSPECTIVE business for November shows a decided increase in the Eastern district, judging from inquiries. October closed with business much better in the Pacific Coast area, especially from industrial sources.

——RAILROAD BUYING IN THE Middle West area is substantial, and there are indications that industrial buying will be much greater in November.

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PACIFIC COAST

—BUSINESS WAS MARKEDLY BETTER *during early October, slumped in mid-month and recovered at the end. An encouraging feature is the number and distribution of stock orders, though quantities are generally small.*

—MARKETS FOR CONDUIT AND WIRE *have been disturbed. Printing firms report record October business, indicating good holiday season, and neon sign manufacturers have been working overtime for weeks past.*

Central-station business is fair, with about $150,000 worth of wire and cable to be placed before January, but there are few machinery orders; indoor golf courses are producing a fairly widespread business, elaborate courses in San Francisco and Los Angeles are making record loads, an outdoor San Francisco course just opened totaling 93 kw.; 200 or 300 outlet factory jobs, which are usually the backbone of the industrial construction, are practically non-existent, but school construction is brisk, with several $2,500 to $10,000 fixture jobs. Outstanding orders include $20,000 worth of Westinghouse 300-kva. subway transformers for Los Angeles, a $25,000 radio transmission equipment for the United States army in the Seattle area, General Electric furnace equipment for a chemical plant near Pittsburg and $15,000 worth of Westinghouse blades and other turbine spares for the Hawaiian Islands. Cable orders include $8,000 worth of varnished cambric and lead cable for a potash company near Trona, $20,000 worth of paper and lead cable for southern California and a prospective installation requiring 5 miles of sizes Nos. 2 and 4 rubber and lead three-conductor cable and traffic signals for a 5-mile section of the Wilshire Boulevard in Los Angeles. Major construction contemplated includes a $1,000,000 county building for San Diego, the new $1,000,000 home of the famous Bohemian Club of San Francisco and a $2,500,000 two-year program for construction and alteration of state hospitals. Street-lighting construction includes a seven-block job for Sacramento at an estimated cost of $3.50 per front foot, a $5,388 award at San Rafael and 77 standards for Long Beach.

Movement of heavy apparatus in the Puget Sound district last week was featured by the sale of six 69-kv., twin-break oil circuit breakers for installation in White River hydro-electric generating station of Puget Sound Power & Light. Equipment will replace old apparatus and represents about $35,000. Inquiries reported are increasing noticeably and sales last week were good, orders including approximately 75 machines from 100 hp. down to mills, allied industrials and dealers, ten from 75 hp. down to pulp and paper mill, twenty from 100 hp. down to industrials and agricultural sources and about twenty to scattered mills. Specifications are reported being written for motors and control apparatus for a large sawmill near Seattle, also for an electric pumping plant amounting to $300,000 for the Howard Flat irrigation project in the Lake Chelan district. General Construction Company, Ltd., Granville Island, was awarded the contract by West Kootenay Power & Light Company, Ltd., Vancouver, B. C., in connection with its hydro-electric development at Corra Linn Falls on Kootenay River, on which approximately $500,000 is being spent at the present time, and the Washington Water Power Company, Spokane, will construct a 9-mile transmission line.

CONSTRUCTION PROJECTS

Pacific Gas & Electric Company, San Francisco, Calif., will build a power substation at Pittsburg, Calif., to cost over $60,000. Southern California Edison Company, Los Angeles, Calif., plans a power substation at Lancaster to cost more than $50,000. Copperconda Company, Los Angeles, Calif., plans a metal refining plant at Santa Ana, Calif., to cost about $100,000. Bids will be asked by the University of California, Berkeley, for a power plant to cost $40,000. Northwestern Electric Company, Portland, Ore., plans a power substation to cost $45,000. B-K-V Battery Separator Company, San Francisco, Calif., plans plant at North Bend, Ore., to cost $100,000. Portland Canal Power Company, Seattle, Wash., is completing plans for a hydro-electric power plant in Alaska to cost $2,500,000.

SOUTHWEST

—GENERAL CONDITIONS SHOW NO CHANGE *since last week that is worthy of note. Perhaps the most noticeable feature is the extreme care shown by purchasers in keeping orders down to a minimum.*

Manufacturers say that practically all buying is from hand to mouth. There are lots of orders, but the aggregate is below normal. Orders of contract size reported are a complete d.c. substation equipment for one of the St. Louis power companies to cost $135,000 and 26 motors to cost $5,000 for the re-equipment of a factory damaged by fire.

CONSTRUCTION PROJECTS

Kansas City Power & Light Company, Kansas City, Mo., has plans nearing completion for an office and operating building to cost $2,000,000. Corn Products Refining Company, North Kansas City, Mo., will build a power house to cost over $65,000. Jenson Brothers Manufacturing Company, Coffeyville, Kan., plans addition to oil well tool plant to cost over $75,000. Century Petroleum Company, Oklahoma City, Okla., has plans for an oil refining plant to cost $100,000. Citizens' Electric Company, Hot Springs, Ark., plans extensions in ornamental lighting system. Southwestern Gas & Electric Company, Shreveport, La., plans power substation at Grand Saline, Texas, to cost over $50,000.

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SOUTHEAST

—THE VOLUME OF ORDERS *continues at a reasonably satisfactory level in the Southeast, but there seems to be no immediate prospects for a material increase. A very satisfactory activity is reported in the lighting field, particularly outdoor lighting.*

A Georgia company's orders last week for weatherproof solid and stranded and bare solid copper wire aggregated $25,000, while its strain and pin type insulator orders totaled $6,000. One company ordered three 100-kva. transformers and distribution and small power transformers amounting to $4,800. A company in Tennessee ordered small power transformers costing $4,000 and a municipal system in South Georgia ordered switchboard equipment amounting to $3,000. Some other central station orders were for creosoted pine poles amounting to $3,400, meters totaling $3,000, and a storage battery costing approximately $1,150. An ice company in Georgia purchased switchboard equipment amounting to $6,000 in connection with an electrification project.

CONSTRUCTION PROJECTS

Chesapeake & Ohio Railroad, Richmond, Va., has approved plans for extensions in shops at Clifton Forge, Va., to cost $150,000. Virginia Electric & Power Company,

Richmond, Va., plans transmission line from Petersburg to Wilson, Va. Northern Virginia Power Company, Winchester, Va., plans transmission lines in different parts of Jefferson County, W. Va., to cost over $60,000. Kentucky Power Corporation, Louisville, Ky., and associated companies plan an expansion and improvement program, reported to cost close to $3,000,000. Raylaine, Inc., Asheville, N. C., will soon begin construction of fiber mill at Biltmore, N. C., to cost about $400,000. Tom Huston Frozen Foods, Inc., Columbus, Ga., contemplates plant at Orlando, Fla., to cost $175,000.

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EASTERN

—THE TURN OF NOVEMBER *shows little change in the situation in the Eastern district, with the important exception, however, of a much better market tone than was evidenced at this time 30 or 60 days ago. Actual orders are scattered, but incoming inquiries continue on an improved level and the coming month is expected to show a substantial increase in business.*

—CENTRAL STATIONS SEEM IN A *better mood for buying, and industrial account, likewise, has far more promise than for some time past. Railway electrification has developed another appropriation of $1,500,000 in the Eastern section during the past week, and immediate marine account shows some heavy expenditures to be made for turbo-electric propulsion equipment, electric winches and kindred apparatus.*

The Philadelphia district shows a decidedly improved market trend, with important developments for electrical account. The Philadelphia & Reading Coal & Iron Company will discontinue operation of its electric generating stations used for coal breaker service, transferring these properties to the Pennsylvania Power & Light Company, which will furnish power in the future for the coal company. With this acquisition, the Pennsylvania company secures an important power site at Herndon, Pa., where a steam-operated electric generating plant will be constructed at an early date, to be equipped for an ultimate output of 500,000 kw., representing an investment of over $25,000,000, with transmission system. Another feature of the week's news from this section is the decision of the Philadelphia & Reading Railway to proceed with the electrification of another portion of its line from Langhorne, Pa., to West Trenton, N. J., at a cost of $1,500,000; the total electrification budget of the road is $21,500,000, a considerable portion of which will be absorbed during the coming year.

A metropolitan power company has placed an order with a state manufacturer for transformers and accessories to cost $150,000. A number of other important contracts for similar equipment are about to mature. A county in Northern New York has ordered a small turbine unit with motor-generator set for an institutional power station, the commitment going to a state producer at a price of $55,000. A municipality in North Carolina has contracted for equipment for city-owned power plant to an amount of $23,000.

CONSTRUCTION PROJECTS

Signal Supply Officer, Army Base, Brooklyn, N. Y., will receive bids until November 12 for switchboards, transformers and other equipment (Circular 41). Commanding Officer, Submarine Mine Depot, Fort Totten, N. Y., will receive bids until November 10 for six motor-generators (Circular 7). American Cyanamid Company, New York, and Pittsburgh Plate Glass Company, Pittsburgh, Pa., plan joint construction of caustic soda manufacturing plant to cost over $400,000. General Electric Company, Schenectady, N. Y., is completing plans for a factory branch and distributing plant at Detroit, Mich., to cost $750,000. Syracuse Lighting Company, Syracuse, N. Y., plans equipment storage and service plant to cost over $100,000. Bergen Square Garage, Jersey City, N. J., is completing plans for service repair and garage building to cost $400,000. Pennsylvania Railroad Company, Pittsburgh, Pa., has approved plans for a grain elevator at Erie, Pa., to cost $400,000, and contemplates new station and terminal improvements at Pittsburgh, to cost about $10,000,000. General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until November 14 for electric motors, magnet wire, transformers, terminal fixtures, electric fixtures and other electrical supplies (Panama Schedule 2601). Bureau of Yards and Docks, Navy Department, Washington, D. C., is asking bids (no closing date stated) for motor-driven air compressors (Specification 6187.)

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NEW ENGLAND

—NEGOTIATIONS AND INQUIRIES *for heavy machinery are at a low ebb; small motor sales declined during the past week and were confined to single orders. General scheduled materials were less active; inquiries for wiring supplies are being received for a number of new institutional types of buildings. Central station supplies are receiving little attention. Less stocking up of line requirements is reported.*

Recent announcement of installations of traffic signals to cost about $100,000 is of interest. The output of lamps from one prominent manufacturer in this district shows a gain to date of about 30 per cent over a corresponding period last year. Radio sales are increasing and electric clocks are in increasing favor.

CONSTRUCTION PROJECTS

Department of Parks, Boston, Mass., plans airport lighting system at proposed municipal airport on Governors Island, entire project to cost over $5,000,000. Anchor Color & Gum Works, Dighton, Mass., has approved plans for power plant to cost $65,000. Boston Consolidated Gas Company, Boston, Mass., has filed plans for a switching station at Everett, Mass. American International Engineers & Equipment Associates Syndicate, Boston, Mass., has plans for a warehouse and industrial terminal to cost over $3,000,000. Sayles Finishing Plants, Inc., Phillipsdale, R. I., plans addition to cost $300,000. Boston plans to spend about $3,500,000 on new schools.

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MIDDLE WEST

—GENERAL BUSINESS IN THE *Middle West section shows a slight improvement. While conditions remain much the same as indicated during the first half of the month, it appears that October will close somewhat more favorably than anticipated. Industrial activity still remains quite spotty, although a seasonal demand for merchandise is creating some business.*

Renewed purchasing among the railroads, of rails and equipment, resumption of work at some of the automobile body plants, and a slight general increase of employment are all encouraging factors. Considerably more forward buying is going on and retail trade appears to be improving. The various utility companies are busy with a certain amount of fall construction. Some of the interesting items placed this week include switchgear and equipment to cost $315,000, switchboard equipment to cost $90,000, "Mazda" lamps valued at $125,000 and several underground conduit installations to cost $75,000. There has been a fair demand for most appliances, particularly for electric refrigerators, one jobber placing a single order for 300 machines. Following a reduction in the price of copper, code wire prices were reduced 5 per cent.

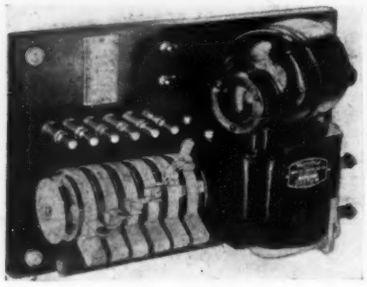
CONSTRUCTION PROJECTS

Milwaukee Valve Company, Milwaukee, Wis., contemplates an addition to cost over $80,000. Metal Process Corporation, Dearborn, Mich., plans addition to cost $90,000. Public Service Company of Northern Illinois, Chicago, has authorized extensions in power substations, transmission and distributing lines to cost $1,000,000. Jeffrey Manufacturing Company, Columbus, Ohio, plans addition to conveying equipment manufacturing plant to cost over $100,000. Jaeger Machine Company, Columbus, Ohio, plans addition to cost close to $100,000. Yankton, S. D., plans ornamental lighting system. Eastern Minnesota Power Company, Pine City, Minn., plans power plant at McGregor, Minn., to cost about $80,000. Board of Public Welfare, Minneapolis, Minn., plans industrial building to cost $100,000. Red Wing, Minn., contemplates ornamental lighting system. Iowa City Light & Power Company, Iowa City, Iowa, plans addition to power plant at Coralville, Iowa, reported to cost over $45,000. Dubuque, Iowa, plans ornamental lighting system.

New Equipment Available

Resetting Afforded in Work-Cycle Timers

WORK-CYCLE TIMERS which are said to meet all timing requirements for various industrial electrical machinery and which may be reset instantly at the starting point at any time during or after the completion of a cycle are an-



nounced by the Monitor Controller Company, Baltimore, Md.

The current-carrying switches in a given unit of this timer are all electrically connected on the pivoted side. Each individual switch consists of a rotatable disk clearing an adjustable contact point and a post fixed on the panel and connected directly to the circuit to be controlled. There are as many of these little switches as there are circuits in the sequence. The rotatable disks are mounted loosely on a sleeve which is carried on a revolving hollow shaft and each disk is set between two rotating disks that are keyed to the shaft.

The rotating hollow shaft is driven by a constant-speed electric motor and a clutch rod operated by a magnet extends through the center of it.

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Long-Lived Crucibles for Induction Furnaces

CRUCIBLES BUILT UP FROM a number of tongued and grooved sections of tile joined by cement for use in induction furnaces for the melting of cast iron and special alloys are announced by the Babcock & Wilcox Company, New York. These crucibles are set into the furnace coil and the intermediate space is packed with mica or asbestos paper.

The crucibles have a rammed lining of cement and, consequently, do not come in direct contact with the metal. By repairing or renewing the cement lining every ten to fifteen melts it is possible to obtain 150 to 200 melts from one crucible, according to the manufacturer. The refractory material from which the crucibles are made is claimed to have a low coefficient of expansion, high strength and to be free from shrinkage.

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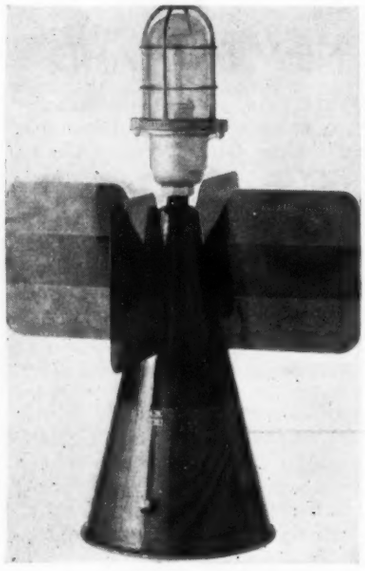
Airport Lights Tip Over When Struck by Plane

AIRPLANE LANDING FIELD marker lights which are highly visible in daylight as well as at night, which do not damage a plane that accidentally strikes them and which automatically provide protection for the circuit in which they are connected are announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

These lights are mounted on a metal cone placed over a disconnecting pothead which is mounted flush with the field surface. When the cone is struck by a moving object it is either tipped out of the way or, in case of snagging, carried along. If a glancing blow is the extent of the impact, the vanes attached to the cone bend out of the way, and permit free passage of the moving object.

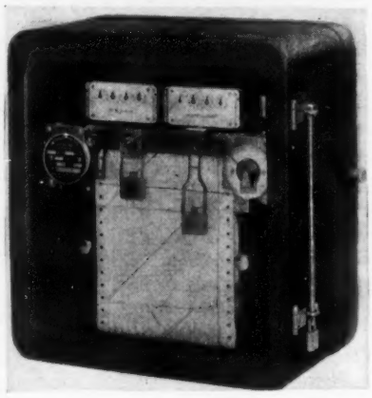
When the cone is struck or removed from the pothead the cap is pulled out simultaneously with the movement of the cone and the light is disconnected.



Then the circuit to the remaining marker lights is reclosed immediately, preventing an interruption of service, and a trap door snaps into place, covering the exposed circuit.

Demand Meter Measures Kva. and Power Factor

METERS FOR MEASURING the kva. demand in connection with the analysis of loads and the measurements of important service have recently been placed on the market by the Sangamo Electric



Company, Springfield, Ill. These meters are auxiliary devices controlled by two watt-hour meters and measure the energy and reactive component, to give, on a single chart, the following information relative to the load: The kva. demand, kw. demand, maximum kw. demand, power factor at the time of demand, reactive component demand, the time that the demand occurred, the energy component in kilowatt-hours and the reactive component in reactive kilovolt-ampere hours. The measurement is so made as to define the kva. demand as the vector sum of the volt-amperes in the individual phases.

These meters, designated Type S, can be obtained for either 50 or 60 cycle operation and are regularly built for 115-volt service.

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Light-Weight Steel Reels of Sturdy Construction

STEEL REELS WHICH APPROXIMATE the weight of corresponding wood reels, but which will not shrink, swell, splinter, damp- or dry-rot have been developed by the Truscon Steel Company, Cleveland. The claims for the new steel reels are rigidity, strength, durability and absence of wear, which insure them an almost indefinite life with a negligible maintenance cost.

A series of comparative drop tests are said to have conclusively demonstrated that these reels will remain intact when the entire assembly of wood reels will loosen, causing wabbling heads, weaving drums and loosened nails, with consequent charring and damage to cable.